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CO-OPERATION IN SECURING NEW BUSINESS.

It is everywhere realized today that an active new-business department is one of the most important elements in the success of a central-station company. Large companies have found it worth while to devote considerable energy and money to the building up of a new-business department which shall be equipped to make active campaigns for adding load to its distributing lines. The company which waits for customers to come to it usually has a very slow development and one of the reasons for the rapid growth of the electrical business in recent years has been the general attitude of central-station companies in actively seeking new business.

In many small towns, however, there is not sufficient prospect of new customers to warrant the maintenance of a staff of solicitors, and such soliciting as is done must fall upon the manager of the plant or some subordinate who has other duties as well. The men who seek contracts under these conditions are usually those who have had no special training for the work and who cannot expect to be so successful as the specialist employed by the larger companies. The business, however, will not warrant the constant employment of a man who can furnish the highest talent along this line.

A solution of this problem for the small company is to secure through a co-operative arrangement with other companies the services of such a specialist for a limited time or for short periods of stated intervals. Thus, conditions might be such that four small companies could afford to employ a first-class man between them, and such a solicitor could devote one week in each month to each of the four companies.

Such a scheme as this was mentioned at a recent meeting of the Committee on New Business of the Ohio Electric Light Association, of which Thomas F. Kelly is chairman, and if there proves to be sufficient demand for services of this character it is probable that the Committee will undertake to secure a man and make arrangements so that the small companies in Ohio may have the use of his services for such periods as they consider desirable. This is an activity that other state associations might well take up, and where the result cannot be achieved through the state organization, local companies might easily through co-operation with each other achieve the same result. With recognition of the importance of

this matter in developing the business of the small company there should be many opportunities for putting this idea into effect. Indeed it might well pay a private concern to supply solicitors from some central bureau for this purpose to any small towns where their services may be desired.

ELECTRIC HEATING AND COOKING.

The competition with gas on the basis of cost is frequently regarded as a most important question to be considered in relation to cooking by electricity and it is true that the greatest impetus to electric cooking and heating in this country has been felt in those sections where coal must be hauled long distances and consequently brings a high price. We should bear in mind in this connection, nevertheless, that in England, where gas is supplied at much lower prices than usually prevail in this country, as for example 60 cents per thousand cubic feet, electric cooking has made much greater progress than it has in this country. Of course this is partly due to the attractive prices at which electric current has been sold for this particular purpose, one cent per kilowatt-hour in addition to a demand charge being the price which is now available in no less than 17 cities. If we regard 90 cents per thousand cubic feet as an average price for gas in this country, we may regard 1.5 cents per kilowatt-hour as a rate for electricity which would put the two upon the same basis as in England. This is a price which American central stations do not seem to be in a position to offer, and a minimum for this class of service, even where special arrangements might be made to obtain such a load, would more likely be double this amount.

However, the question of price is not the only element to be considered with respect to electric cooking. Cooking at a lower temperature, which is the universal accompaniment of the electrical method, results in more savory and digestible dishes and in an appreciable saving in the weight of meats. This saving has been scoffed at in some quarters, it being represented that the loss consists of nothing more than water vapor. While this is not strictly true, its assumption does not weaken the electrical argument. A large part of all our food is made up of hydrogen and oxygen in the proportions which form water, and the loss of these elements is an actual loss of food. It must be remembered, moreover, that meat and other edibles are purchased at so much per pound, water vapor and wastes included. The question of the loss of weight and consequently of material available for food is, therefore, an important one, since the moisture present should be conserved to as great an extent as possible. There are moreover other compounds present in food which are volatilized at a high temperature, and still others which are chemically changed to a less digestible form by being raised to a high temperature.

Other well known advantages of electric cooking and heating, such as convenience, cleanliness, ease of control, safety, etc., need not be dwelt upon here.

It is only in some of our Western states that these applications of electric current have received the attention which they deserve. Two articles in this issue call detailed attention to these applications. There are a number of towns in Idaho where electric heating in buildings is being carried on upon a large scale. The high school at Rupert, for example, consumes 400 kilowatts when utilizing the maximum capacity of its electric heaters. Where such installations have been tried, the sentiment based upon experience is invariably in favor of their use.

PROGRESS ON NEW HAVEN ELECTRIFICATION.

It is anticipated that by June 1 electric freight, passenger and switching service will be in operation between New York and New Haven, Conn., and that many results of electrical operation throughout a complete engine stage will soon be available to the New York, New Haven & Hartford Railroad as a basis for further developments when the financial condition of the company permits expansive measures. A brief résumé of this famous electrification, which is of the trunk-line type despite its association with New York terminal conditions, is suggestive at this time.

The original electrification of the road between Stamford and Woodlawn, begun in 1905 and completed in 1907, embraced 21.5 miles of route and 110 miles of single track. As the New York Central & Hudson River Railroad had during the year previous electrified its track from the Grand Central Station to Woodlawn, where the junction with the New Haven tracks is made, this made the total route distance for the New Haven's original electric service, between the Grand Central Station and Stamford, 33 miles. The original electrification plant included, besides the overhead system of alternating-current distribution, the power station at Cos Cob and 41 electric locomotives. This equipment was sufficient to permit of full electric passenger service between New York and Stamford, where the transfer is still made between electric and steam operation.

After a considerable experience with the electric service between these points, it was decided to electrify the six-track Harlem River branch of the New Haven road, connecting Harlem River with the main line at New Rochelle, and subsequently to extend the electrification eastward from Stamford to New Haven. In these plans the final object in mind was the putting of all passenger, freight and switching service upon an electric basis. With this end in view, appropriations were made for an addition to the electrical output of the Cos Cob station, for additions to the main line, yards and siding electrification and for additional locomotives of the freight and switching type. The increase in the output of the Cos Cob station as provided for in these appropriations will permit of a very large percentage of complete electric service in the New York-New Haven zone as soon as the overhead contact and distribution system is ready. It will not, however,

permit of 100 per cent of electric service—the abolition of every steam locomotive from the tracks—until additional generating facilities are available at the eastern and western ends of the line. For the time being such plants will not be built, and hence the full economic possibilities of the electrification in the New York-New Haven engine stage must be again left unrealized until the resources of the company enable the complete engineering development to be made, or until power can be advantageously purchased on the necessary scale for reliable and ample service.

SUPPLY OF ELECTRIC POWER TO LONDON.

London, the largest city in the world, is made up of a number of boroughs, most of which have at present separate central stations for supplying electric power, some of these being operated by the boroughs and others by private companies. Strict geographical lines constrain each of these stations to its own specific territory, with the result that none of the generating stations is very large in comparison to what may be found in other cities of the first magnitude. Attention has frequently been called to the disadvantages of such a system of electrical supply, but on account of the various interests involved, little has yet been accomplished towards consolidating these systems, although the project has been advanced a number of times and the best engineering talent has pointed out its desirability to the people of London.

Recently a report has been rendered by a firm of consulting engineers to the London County Council, a brief abstract of which will be found elsewhere in this issue. This report is in conformity with what every well informed engineer would expect. It recommends the establishment of one or more large generating stations along the Thames River outside of the city limits, with three-phase transmission at high voltage to substations in different parts of the city. This is an ultimate ideal whose adoption would result in a great saving in operating expenses—a saving which would more than offset the additional investment required for the new generating stations. It is an ideal, however, that can best be approached by successive steps rather than by the immediate abandonment of all the present generating stations within the city. It is an ideal towards which, no doubt, developments will be aimed, although how soon it may be realized is another question.

Many steps are necessary in the consummation of such a plan. First of all the consent of Parliament must be obtained for the consolidation of the present companies or the formation of a holding company which shall take over their interests. The consent of the existing companies, the franchises of some of which have a long period yet to run, must also be secured, and this, of course, can only be done by offering their stockholders something attractive in the way of outright purchase or exchange of shares in a consolidated company. The London County Council, moreover, has the option of purchase of certain of the present private companies, and this body seems at present uncertain as to whether to inaugurate a more extensive system of municipal ownership than now exists.

The advantages of a consolidated system would cover more than a decrease in operating expenses. The present heterogeneity of voltage, frequency, etc., in the various districts would ultimately disappear and advantage could be taken of the diversity of the load in the different sections of the city. Moreover, even if the present generating stations were not abandoned, the consolidation into one system with connections between stations for emergency supply in cases of breakdown would add greatly to the security and continuity of service.

THE PERCENTAGE SYSTEM IN ELECTRICAL CONTRACTING.

On other pages of this issue we present an article entitled "The Percentage System in Electrical Contracting." From the author's point of view this is one of the most important and interesting developments in the electrical contracting business. The advantages and similarly the disadvantages are pointed out and as clear a case as may be is made for the proposition.

Believing that there are many debatable points associated with an issue of this character, we sought an expression of opinion as to the merits of this method of doing business from a number of leading electrical contractors in the United States. As a result of their courtesy and co-operation we are able to publish in connection with this article the opinions of these leading electrical contractors, and while there is considerable variance, the drift of opinion generally is against the proposition.

Whether the percentage system is a good thing or not depends finally upon the attitude of the electrical contractor who decides to engage in business under its stipulations. It is a peculiar thing, however, that the percentage system is a good system when the contractor approaches a job on a business basis. Where he is not prepared to analyze thoroughly his overhead expense and the margin of profit to which he is entitled, he cannot fearlessly and logically insist upon a percentage and a method of figuring costs which will leave him the reward to which his brains and energy are entitled. If the discussion of this matter so far has developed anything at all, it is the further emphasis of the desirability, in fact, the absolute necessity, of the electrical contractor appreciating the fact that he is in a business that consumes time and talent, to say nothing of the most arduous labor, and that unless he capitalizes these factors in his business and exacts a return therefor, he cannot make a success under the percentage system or under any other system of doing business.

Chicago Vehicle Association Meeting.

The annual dinner meeting of the Chicago Section, Electric Vehicle Association of America was held in the Louis XVI Room, Hotel Sherman on May 5. After the secretary's report, Chairman Niesz delivered a short address in which he told of the activities of the section during the year. This was followed by the election of officers, the following officers being elected: Chairman W. J. McDowell; vice-chairman, L. E. Wagner; secretary-treasurer, F. E. McCall; executive committee, H. E. Niesz, C. B. Frayer, H. Salvat and D. C. Arlington. After a few remarks from the incoming officers, the president introduced J. F. Gilchrist, who, as toastmaster, introduced the speakers of the evening.

J. E. Hale, of the Goodyear Tire and Rubber Company, who was the first speaker, delivered a paper on tires. After tracing the development of the pneumatic tire from the early days of the bicycle to the present time, he called attention to some of the problems in tire design, including fabrication and compounding. Improved methods of manufacture have greatly increased the life of tires, but their design is still a compromise between those qualities giving length of service and those giving easy-running characteristics.

D. M. Simpson, of the Electric Storage Battery Company, then gave an illustrated talk on the Exide constant-potential system of battery charging for garages. After explaining the action of the negative plate of a battery during charging and discharging, he pointed out that by using a constant charging voltage of 2.3 volts per cell the battery can be charged in a comparatively short time without any attention, the charging current being great at the beginning of the charge and decreasing as the battery assumes its charge. Such a system of charging was said to cause no excessive peak loads in most cases as the arrival of cars in a garage for charging purposes is generally such as to distribute the great initial charging current required in this system over a long period of time. Inquiries in the city of Chicago had shown that the power bills for charging service have been reduced about 11 per cent by the adoption of this system.

Frank W. Smith, of New York City, president of the Electric Vehicle Association of America, then told of the work of the Association. Sections have recently been organized in Philadelphia, Washington, Cincinnati and San Francisco. Efforts are now being made to interest the postal authorities in the electric vehicle for parcel-post delivery.

Dean H. M. Raymond of the Armour Institute of Technology told of the intended inauguration of a night course in electric-vehicle engineering at the Institute next fall. W. C. L. Elgin, vice-president of the Philadelphia Electric Company, gave a very enthusiastic talk on confidence in electric-vehicle salesmanship.

The National Electric Light Association Convention

A circular dealing with the plans for registration, transportation and hotel accommodations has been issued by the General Convention Committee of the National Electric Light Association. The convention will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., June 1 to 5, inclusive.

Registration will be handled as in previous years and the Convention Committee emphasizes strongly the importance of early advance registration. This will enable those in charge of the work to properly handle all of the details, particularly the preparation of badges, which are individual and require special attention.

The Transportation Committee, under the direction of George W. Elliott, master of transportation, reports the completion of arrangements for a number of special trains.

The "Green" special will leave Chicago over the Pennsylvania lines at 3:00 p. m., Sunday, May 31, arriving at Philadelphia at 12:00 o'clock noon, June 1. This train will be under direct personal charge of G. A. Freeman, 120 West Adams Street, Chicago.

The "Brown" special will leave Chicago over the Lake Shore Railroad at 10:15 a. m., Sunday, May 31, from La Salle Street station, arriving at Philadelphia at 10:15 a. m., June 1 This train will be under the direct personal charge from Chicago of H. N. Sibbald, traffic manager of the National Lamp Works, Nela Park, Cleveland, O.

The "Golden Poppy" special will leave San Francisco, Cal., from Oakland station, May 26, making stops at Salt Lake City and Ogden, where it will be joined by the Seattle and Pacific Northwest contingent, and at Denver, where the Colorado delegation will be attached. This train will arrive at Broad Street station, May 31, and will be in direct personal charge of E. B. Strong, publisher of the *Journal of Electricity, Power and Gas*, Rialto Building, San Francisco.

The "Magnolia" special will leave the terminal station at Atlanta, Ga., at 2:45 p. m., May 31, arriving at Philadelphia at 2:30 p. m., June 1. This train will be under the direct personal charge of A. H. Sikes, of the Athens Railway & Electric Company, Athens, Ga.

Representatives of central stations throughout the Southwest will leave Kansas City, Mo., for the National Electric Light Asscoiation's convention at Philadelphia in a special train, according to present plans. Members of the Association in the Southwest will assemble at Kansas City. They will be joined there by local electric light men and the entire party will then proceed on a special train. Kansas City alone will send 30 or 40 representatives to the convention.

There will be no New York specials, as there is excellent regular train service between that city and Philadelphia. The short time required makes unnecessary a special accommodation. The various railroad associations throughout the country have authorized reduced fares, with the exception of the Eastern Canadian Passenger Association.

The Exhibition Committee, H. G McConnaughy, secretary, announces the following list of exhibitors for the Philadelphia convention of the National Electric Light Association: American District Steam Company, American Ironing Machine Company, Barnes & Kobert Manufacturing Company, Bell Electric Motor Company, James G. Biddle, Century Electric Company, *Central Station*, Cooper-Hewitt Electric Company, George Cutter Company, Delta-Star Electric Company, Edison Lamp Works of General Electric Company, Edison Storage Battery Company, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, *Electrical World*, Electric Service Supplies Company, Electric Storage Battery Company, Federal Sign System (Electric), G & W Electric Specialty Company, General Electric Company, General Vehicle Company, Incorporated, Hubbard & Company, Hughes Electric Heating Company, Hurley Machine Company, H. W. Johns-Manville Company, Lombard Governor Company, Metropolitan Engineering Company, National Lamp Works of General Electric Company, Naugle Pole & Tie Company, Ohio Brass Company, Otis Elevator Company, Philadelphia Electrical & Manufacturing Company, Philadelphia Electric Company (Supply Department), Philadelphia Storage Battery Company, Pittsburgh Transformer Company, John A. Roebling's Sons Company, Rumsey Electric Company, Sangamo Electric Company, Simplex Electric Heating Company, Southern Exchange Company, Standard Underground Cable Company, Wagner Electric Manufacturing Company, Western Electric Company, Westinghouse Electric & Manufacturing Company, Westinghouse Lamp Company, Westinghouse Machine Company, Weston Electrical Instrument Company.

James D. Mortimer.

James D. Mortimer, recently elected president of the North American Company, has had a most exciting and one might say spectacular career. He is one of the conspicuous examples of what American engineering possibilities hold out to the man of culture, intellectuality, broad experience and high courage.

Mr. Mortimer, who is now but 35 years of age, was born in Elmhurst, Ill. He went to California with his parents in 1895, and entered Throop Polytechnic Institute at Pasadena, where he took electrical work. From 1896 to 1897 he worked on a fruit ranch at Riverside, Cal., for his parents. In the fall of 1897 he applied for entrance to the University of California in the scientific department, but was rejected because of his youth. However, the indomitable spirit, manifesting itself already, constrained him to begin going to the classes in the sophomore year without registering as a student. In the fall of 1898, after the faculty had discovered that he had been unofficially a student during the previous year, he registered as a junior and graduated with the class of 1900, being immediately appointed an instructor in engineering. In 1902 he was made superintendent of power of the Tacoma Railway & Power Company, and in 1903 he became engineer for Stone & Webster, of Boston, developing the Puyallup River power scheme, which supplies Tacoma and Seattle with power and light.

As engineer in charge of various electric light, gas, traction and water power enterprises for the Electric Bond & Share Company, of New York, in various cities from New York to California, he achieved a still greater reputation, and from 1904 to 1909 carried on a great work of reorganization, rehabilitation and development.

As a result of his work with the Telluride Power Company of Utah and Colorado, he was engaged in 1911 by the North American Company, and in 1911 was sent to Milwaukee as president of the Wisconsin properties of the North American Company with a title of vice-president of the general company. In 1914 he was elected president of the North American Company, when his sponsor, James Campbell, of St. Louis, became chairman of the executive board.

At Throop Polytechnic, Mr. Mortimer was an ardent student and during practically the entire course was a medal man, retaining his position at the head of his class in practically every study.

Mr. Mortimer came in contact with James Campbell, then president of the North American Company, in May, 1909, while investigating the condition of the Telluride Power Company. Mr. Campbell is known as the richest man in St. Louis, with extensive holdings in a number of big institutions. Mr. Campbell was impressed with the way Mortimer investigated the affairs of the Telluride Company, and decided that his own organization needed a man of the latter's caliber and capacity.

Mr. Mortimer now makes his headquarters at Milwaukee, Wis. In and about Milwaukee alone the North American Company controls the Milwaukee Electric Railway & Light Company, the Milwaukee Light & Traction Company, the Milwaukee Central Heating Company, the Racine Gas & Light Company, the Kenosha Gas & Electric Company, and the Watertown Gas & Electric Company. The company controls also the St. Louis Union Traction lines and owned the Laclede Gas Company until the Missouri anti-trust law forced the disassociation of the gas and electric lighting companies. The North American Company also owns coal properties in Kentucky, and has heavy holdings in the Detroit public utilities.

James D. Mortimer,
President of the North American Company.

International Engineering Congress.

Rapid progress is being made in working out the final program of papers for the International Engineering Congress to be held in San Francisco in 1915. The first volume of the publication of the Congress will consist of a series of articles descriptive of the various technical features of the design and construction of the Panama Canal.

Subscriptions to the Congress are being received daily and on March 1 the number of enrollment was slightly in excess of 1,200, of which over 200 are from foreign countries and about 1,000 from the United States. Subscription blanks have been mailed through the various national societies to many thousands of engineers in this country and through the foreign societies to foreign engineers. The response already received is very encouraging, but it is trusted that all engineers interested in the success of the Congress will not fail to send in their subscriptions as early as possible. Delay in so doing renders the task of the Committee of Management more difficult, and makes it impossible to form any just estimate of the receipts which may be expected and the number of copies of the volumes which have to be published.

E. J. Dupuy is executive secretary of the Committee of Management. His office is in the Foxcroft Building, San Francisco, Cal.

Electric Club of Chicago.

Anderson Pace, industrial commissioner of the Chicago Association of Commerce, was the principal speaker at the meeting of the Electric Club of Chicago on April 30. Mr. Pace spoke on the subject of "Loyalty," showing how the tendency of employers today is to discourage rather than encourage the loyalty of employees. The best solution of the problem, he said, is to make employees selfishly interested in the firms for which they work, by making them stockholders and not impressing upon them that their places can easily be filled.

A smoker and entertainment was held on April 29 at the Hotel Sherman, with over 560 members and guests present. A seven-act vaudeville bill was provided and music was furnished by the Commonwealth Edison Company Mandolin Orchestra.

Cincinnati Jovian Meeting.

The recent monthly luncheon of the Cincinnati, (O.) branch of the Jovian Order at the Hotel Gibson was addressed by G. W. Hill, of Utica, N. Y., special representative of the National Electrical Contractors' Association, who advised the members to cooperate with all lines of trade in their work, and by President W. W. Freeman of the Union Gas & Electric Company, who also talked about co-operation. Mr. Freeman declared that Cincinnati is known all over the country as being well advanced in this respect, pointing to the small amount of friction resulting in consequence, between the various branches of trade which meet in electrical work. Statesman James S. Schrantz, local manager for the Westinghouse Electric & Manufacturing Company, presided.

These Monday luncheons have become very popular with the members of the organization, and are always well attended. There were about 60 present at the meeting referred to. Arrangements have been completed for a rejuvenation to be held on May 18, at which a large number of initiates will enter the Order.

Meeting of Chicago Jovian League.

At the meeting of the Jovian League of Chicago on May 4, W. S. Vivian, secretary Independent Telephone Association of America, delivered an interesting talk on "The Value of Associations," in which he emphasized the value of association with competitors and men engaged in other fields of an industry at luncheon tables and meetings.

E. C. Lewis, who for many years was prominent in the Independent Telephone Association, and now a "big brother" in the Elks, presided and introduced the speaker after making a few remarks on the big-brother movement.

Jovian League of Erie Organized.

The Jovian League of Erie was put on a permanent basis recently at a dinner held in the Reed House, Erie, Pa. Officers were elected and a constitution and by-laws adopted. The officers of the league are as follows: President, Edward Semmence; vice-president, Matthew Griswold, Jr.; secretary-treasurer, J. H. McCarthy; executive committee, F. B. Hofft, T. E. F. Payton, W. H. Wilson, C. H. Cropsey. Permanent quarters, to be known as the Erie Jovian Hall, have been engaged in the Reed House, and the first and third Mondays of each month have been set aside for regular meetings.

Meeting of Jovian League of Southern California.

J. H. Francis, superintendent of schools of Los Angeles, Cal., delivered an address before the Southern California Jovian League at the regular weekly luncheon Wednesday, April 29, at Christophers, Los Angeles, Cal. His subject was "Education and Life." Mr. Francis gave an interesting talk on modern education, explaining his progressive ideas, which built up for Los Angeles a school system second to none in the country. The Jovian quartet, composed of L. E. Darrow, C. Rand, S. A. Searle, and C. C. Young, made its initial appearance. The selections were well rendered and the quartet will no doubt be a permanent addition to the League. Carl C. Young acted as chairman of the day.

Chicago National Fire Protection Association Meeting.

The Chicago Chapter of the National Fire Protection Association of America met on Friday, May 1, in the Assembly room of the Insurance Exchange. Short talks were delivered by representatives of the municipal departments on the subject "Problems Confronting the Chicago Chapter."

H. King, of the Gas and Electrical Department, delivered an interesting talk on "Stray Electric Currents." Considering the subject from the point of view of fire hazard, he considered the stray currents on the return systems of the elevated and surface roads of most importance, while the stray currents of the telephone and power companies he claimed were of negligible importance. A number of incidents were given where the stray currents from the elevated systems in the business district had heated rivets in the structural steel work of buildings to a red heat. Attempts are now being made to reduce these stray currents by equalizing the potential drop along return systems. In cases where the voltage drop is excessive, insulated return conductors are being recommended. The city council recently adopted the limitation of one volt drop per 1,000 feet in the downtown district and one volt drop per 700 feet in the outlying districts.

V. H. Tousley, Chief Electrical Inspector of Chicago, then spoke on the work of the Electrical Inspection Bureau. Under the present system inspection is not only made of new buildings, but old buildings are inspected at frequent intervals. Pole lines, underground conduits, and electric signs are also inspected. By means of frequent inspection of motion-picture houses, the fire hazards in such theaters have been greatly reduced. Efforts are now being made to enforce the removal of wires passing over the roofs of buildings. In conclusion he emphasized the necessary for a life-protection association.

Expert Report on London Electrical Supply.

The future of London's electric supply is reported upon in great detail by Merz and McLellan, consulting engineers, in a document presented to the London County Council in April. Compared to other big cities of the world, the London area is notorious for its variety and multiplicity of generating stations and systems of supply. The necessity for more uniformity and for a new authority to control all of these undertakings is recognized.

Merz and McLellan do not advise any attempt to obtain long-distance electrical transmission from the coalfields at present, but recommend the concentration of the generating plants on sites along the Thames River. In order to carry out this policy with a minimum waste of capital, a high-voltage three-phase 50-cycle primary distribution system is recommended to be standardized for London as soon as possible. For economical and other reasons it is considered advisable not to extend low-pressure distribution networks, but to supplement these by standard three-phase networks. The establishment of a new undertaking with such powers as will enable it to gradually concentrate production, standardize distribution, and bring about the amalgamation of all the various undertakings, is recommended.

In considering economies in production, they say that a saving of not less than 18 per cent, or about $770,000 a year, after allowing for all capital charges, can be effected by shutting down all existing generating stations for the supply of light and power in the central zone and substituting therefor power obtained from sites on the Thames River. The initial capital outlay for this purpose, allowing for growth of demand during the next four years, would be between $27,300,000 and $32,000,000.

Chicago Section to Discuss Brightness.

At the regular monthly meeting of the Chicago Section, Illuminating Engineering Society, to be held on the evening of May 13, a paper will be presented by J. R. Cravath entitled "Brightness." W. A. Durgin will give a talk on "The Fundamentals of Illumination.'

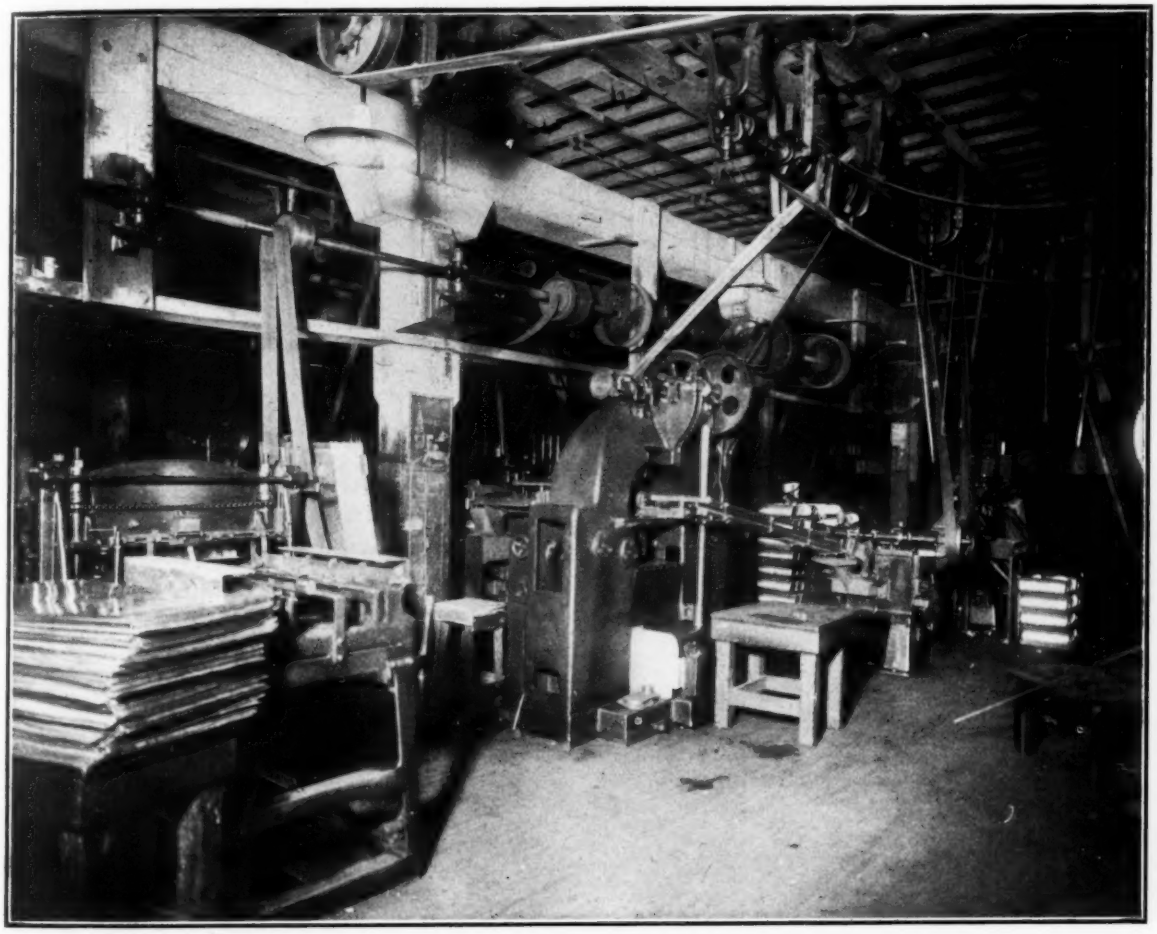
Petition for Receiver for Standard Electric Denied.

The petition for an interlocutory receiver for the Standard Electric Car Company, of Jackson, Mich., referred to in our issue of May 2, was denied on April 27.

Electricity in Can Manufacturing.

This article discusses the advantages of motor drive and central-station power to tin-can manufacturing, showing how the product of an establishment can be increased from 10 to 30 per cent by the application of a proper system of drive. Data are given on the motor installations of three typical plants.

There seems to be a hesitancy on the part of manufacturers of tin cans and boxes in applying motor drive because of the fact that group drive is usually necessary and it is erroneously thought that no economies could be effected by substituting group motor drive for the line shafting ordinarily used. As a matter of fact those plants that have made the change have increased their production from 10 to 30 per cent, without an increase in labor or machinery, and the many other advantages incident to the use of central-station service have had an important bearing on the greater use of electricity in this industry.



Line of Can-Making Machines Driven by 20-Horsepower Motor.

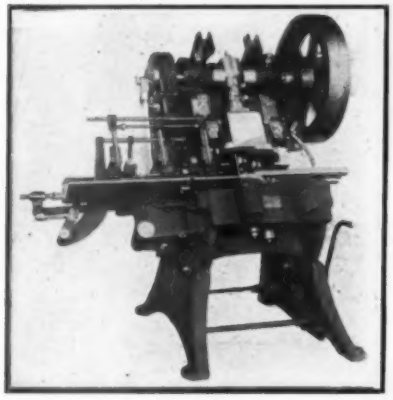
Briefly these arguments can be summed up as follows: (1) ease and economy of electric-power transmission; (2) flexibility of location of machines in the building; (3) accessibility of motor-driven machines; (4) wide choice of motors as to size, mechanical design, and operating characteristics; (5) perfect control, including readiness of starting, stopping and making speed adjustments; (6) economy of power and labor; (7) ability to operate any portion of a shop at any time with power consumption proportional to work done; (8) reduced hazard of accident.

Industrial work generally requires the application of power at distributed points. No form of prime mover is available which can economically develop power in small quantities at the points of application. The electric motor furnishes the nearest approach to this condition in that electric energy can be economically transmitted and transferred into mechanical energy at the point of application in any quantity desired. When compared with line shafting and belts, the installation of wires for carrying electric current is a very simple and inexpensive operation; in comparing the relative losses in transmission the electrical losses seems almost insignificant.

With electric drive the location of buildings and of the individual machines in a shop is practically unhampered by consideration of power. Buildings can be placed with reference to good labor and transportation facilities, convenience with reference to each other, safety from fires or other disasters, etc., in any case electric energy is easily brought to the required location, the necessary wires being easily installed in space not valuable for other purposes. The machines in a plant can be placed so as to require

minimum handling of material and to obtain most economical production; also better light and ventilation can be given proper consideration. No matter how remote or inaccessible the corner in which the work is to be done, the motor-driven machine can fill the requirements.

The flexibility extends to the re-arrangement of machines to conform to changing manufacturing requirements. A motor-driven machine can be moved from one location to another as a unit without disturbing or interrupting any other machines. The only changes required on account of the power supply are the disconnection of the electric conductors in the old location and their reconnection after the machine is moved. This process is extremely simple compared with that of relocating line shafts and belts. The best



Motor-Driven Punch Press.

arrangement for maximum productive economy can thus be maintained, under changing manufacturing conditions.

Additions to plants employing motor-driven machines and central-station service require very little consideration on account of power, other than the wiring.

With motor drive the machines become more accessible and the operators are unhampered by the close proximity of countershafts and overhead belts.

Electric motors are standardized in sizes, shapes and with operating characteristics suitable for almost every conceivable application.

By the use of the motor for each machine any machine can be shut down when not in use, thus stopping all wear and loss of power in friction. This is not the case with the line shaft drive, as the wear and the friction losses in the shafting are only slightly less when all the belts are on their loose pulleys than when all the machines are working.

Conditions that must be met by the power engineer in applying motor drive to can factories can best be illustrated by a description of a typical plant using purchased power. This plant operates only about seven months of the year, the production for this period aggregating approximately 6,000,000 cans. There are 35 men employed working 10 hours per day.

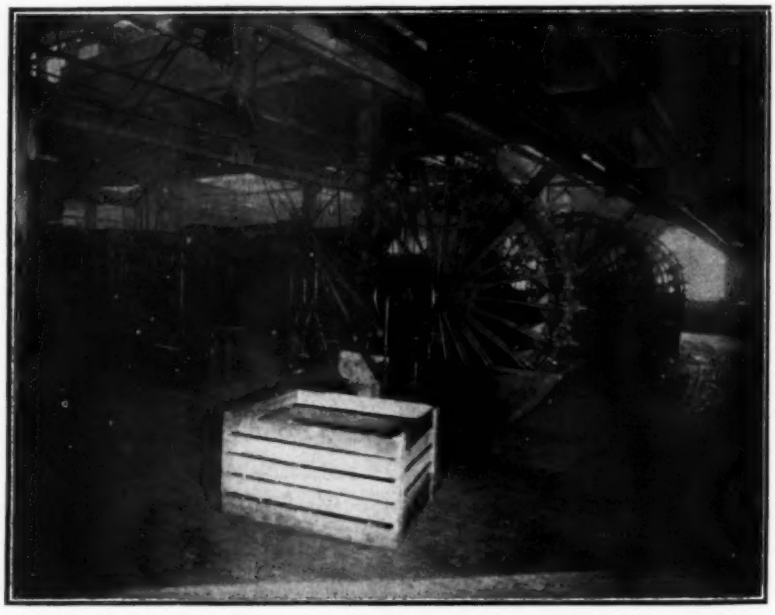
Group drive is used throughout, with the exception of a three horsepower motor which is belted direct to the mechanism of a 600-pound freight elevator. This motor runs at a speed of 1,120 revolutions per minute.

The total connected horsepower is 22.5, comprising Westinghouse squirrel-cage induction motors. The company receives three-phase 60-cycle alternating current from the local central station at a pressure of 220 volts.

There are five motors installed, including the elevator motor, and the machines are so grouped on these motors that minimum handling of material is necessary.

Group I comprises a five-horsepower motor, running at 840 revolutions per minute belted to a 35-foot line shaft with nine hangers and from this to

Group of Can-Making Machines Driven by 15-Horsepower Motor.



Battery of Can-Testing Machines, Motor Driven.

Can Manufacturing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Tin-can factory manufacturing approximately 1,000,000 cans per month. These include lard pails, sheet-steel sanitary tanks and a general line of tin cans. There are 35 men and 5 girls employed, working 10 hours per day.

Total connected horsepower, 37.5. Total number of motors installed, 6. Average kilowatt-hours per month, 1,615. Average kilowatt-hours per month per horsepower connected, 43.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	395	May	1,344	September	1,889
February	1,564	June	1,409	October	2,122
March	1,435	July	2,121	November	1,919
April	1,561	August	1,710	December	1,903

Load-factor, 8 per cent; operating-time load-factor, 14.8 per cent.

The approximate electrical energy consumption per 1,000 cans manufactured is 1.61 kilowatt-hours.

Consumption figures given above do not include a five-horsepower direct-current elevator motor.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-Power.	Speed R. P. M.	Application.
1	15	1,120	Belted to a 35-foot line shaft, 35 hangers, and two two-hanger countershafts driving one George A. Ohl seven-foot-wide sheet-metal press, driven flywheel 36-inch diameter, rim 7 inches by 4 inches; one Niagara No. 262 shear, driven flywheel 20-inch diameter, rim 4 inches by 2 inches; one Canedy Otto Manufacturing Company No. 15 20-inch drill; one Builders' Iron Foundry No. 12 double carborundum wheel, 8 inch by 1 inch wheels; and one Niagara No. 4 punch, driven flywheel 28-inch diameter, rim 4 inches by 2 inches. These machines are all used in the sheet-steel tank department.
1	7.5	840	Belted to an eight-foot shaft, three hangers, and 43 feet of countershafting, 15 hangers, driving one Garden City No. 2 positive-pressure blower, 156 revolutions per minute, furnishing air to a carbureter; one American 6 inch by 6 inch single-cylinder vertical air compressor, flywheel 28-inch diameter, rim 5.5 inches by 1.5 inches, speed 140 revolutons per minute, furnishes air to can-testing machine; one single-cylinder pump for supplying gasoline from underground tank to carbureter; one Torris Wold ribbon solder maker, two 18-inch by 6-inch rolls; one "end floater" which consists of two belt conveyors and a chain conveyor which carry cans past gas torches and a solder feed; one can elevator.
1	5	840	Belted to a 35-foot shaft, nine hangers, and five two-hanger countershafts driving one Stevenson Manufacturing Company punch for punching out one-inch diameter tin disks used for sealing ends of cans, flywheel 20-inch diameter, rim 3 inches by 1.75 inches; two Torris Wold solder hemming machines used for stamping a piece of solder around the circumference of the disks, pulley 24 inches by 4 inches, speed 40 revolutions per minute; one solder trimmer; three Mitchell tin slitters, two pulleys 16 inches by 3 inches on each machine; two Stevenson Manufacturing Company lock-seaming machines used for forming, seaming and soldering the body of the can, flywheel 24-inch diameter, rim 3.5 inches by 2 inches, speed 102 revolutions per minute, capacity 102 bodies per minute. Machines are never operated together.
1	5	1,120	Belted to a 30-foot shaft, eight hangers and 15 feet of countershafting, five hangers, driving five Slaysman & Company cutting presses used for cutting and pressing ends of cans, flywheel 20-inch diameter, rim 3 inches by 2 inches, speed 150 revolutions per minute; and one Stevenson Manufacturing Company can-testing machine, capacity 104 cans per minute.
1	5	840	Belted to a 15-foot line shaft, five hangers, and 14 feet of countershafting, seven hangers, driving one 20-foot chain conveyor; one crimping machine; two can elevators; one ending machine; one solder machine; and one 600-pound freight elevator.

Can Manufacturing Data—Sheet No. 2.

Tin-can manufacturing plant having a maximum capacity of about 1,500 cans per minute. There are 11 "lines" of can-making machines each having a capacity of 140 cans per minute. Plant operates 10 hours per day.

Total connected horsepower, 154. Total number of motors installed, 25. Average kilowatt-hours per month, 24,438.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	12,869	May	29,119	September	28,194
February	13,589	June	28,380	October	15,662
March	22,775	July	29,175	November	10,382
April	29,403	August	29,948	December	14,371

Load-factor, 28 per cent; operating-time load-factor, 61 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-Power.	Speed R. P. M.	Application.
1	20	840	Belted to three line shafts driving 11 body makers; 15 Mitchell tin splitters, two pulleys 16 inches by 3 inches on each machine; 11 headers; 11 crimping machines, used to tighten the seams in the ends of the can; and one vacuum pump.
1	30	840	Belted to two line shafts driving 15 Gann punch presses.
1	15	1,120	Belted to a line shaft driving one air compressor which furnishes air to can-testing machines.
1	15	1,120	Belted to a line shaft driving 11 Fladder machines; 22 can-testing machines; and 11 can-drying machines.
1	15	840	Belted direct to a suction fan for removing waste from machines.
1	10	1,120	Belted direct to mechanism of freight elevator.
1	10	840	Belted to line shaft driving two Torris Wold Company solder hemming machines, used for stamping a piece of solder around the circumference of the disks.
1	5	1,120	Belted to line shaft driving machine-shop equipment including two lathes; drill press; shaper; and emery wheels.
1	5	1,120	Belted direct to ventilating fan.
1	5	1,120	Belted direct to hot-air fan.
1	5	1,120	Geared to mechanism of freight elevator in warehouse.
1	5	1,120	Belted to a line shaft driving 20 single punch presses.
1	3	1,800	Belted direct to saw.
1	3	....	Driving gas machine.
1	2	1,120	Belted direct to can hoist.
10	0.5	1,120	Each driving portable can elevator.

Tin-can manufacturing plant manufacturing a complete line of small size tin cans and boxes.

Total connected horsepower, 20. Total number of motors installed, 3. Average kilowatt-hours per month, 1,590.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	828	May	1,337	September	2,338
February	944	June	1,901	October	1,876
March	547	July	2,685	November	1,521
April	741	August	3,629	December	841

Load-factor 14.6 per cent; operating-time load-factor 30.5 per cent.

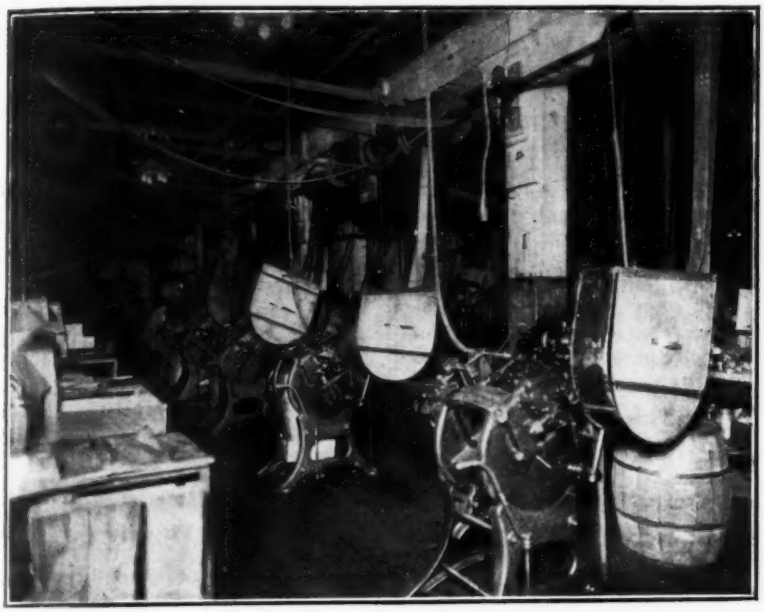
MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-Power.	Speed R. P. M.	Application.
1	7.5	840	Belted to a 35-foot shaft and three countershafts driving two Stevenson Manufacturing Company punches for punching out ends of cans; two solder hemming machines; one United Manufacturing Company ending machine; three Mitchell tin slitters; two can elevators; and two solder trimmers.
1	7.5	840	Belted to a line shaft driving six crimping machines; six heading machines; and one air compressor for furnishing air to can-testing machine.
1	5	1,120	Belted to line shafting driving six cutting presses used for cutting and pressing ends of cans; one Stevenson Manufacturing Company can-testing machine; two crimping machines for tightening seams in the ends of the can.

five two-hanger countershafts driving the following:

One Stevenson Manufacturing Company punch for punching out one-inch diameter tin disks used for sealing ends of the cans. The flywheel of this machine is 20 inches in diameter and the rim 3 inches by 1.75 inches.



Group of Motor-Driven Punch Presses.

Two Torris Wold Company solder hemming machines, which are used for stamping a piece of solder around the circumference of the disks. The pulley of this machine is 24 inches by 4 inches. The normal operating speed is about 40 revolutions per minute.

One solder trimmer.

Three Mitchell tin slitters. There are two 16 inch by 3 inch pulleys on each of these machines.

Two Stevenson Manufacturing Company lock-seaming machines used for forming, seaming and soldering the body of the can. The flywheel of this machine is 24 inches in diameter, the rim 3.5 inches by 2 inches. The machine operates at a normal speed of 102 revolutions per minute and has a capacity of 102 bodies per minute.

Motor Driving Body Presses.

There is also connected to this shafting a 12-inch Buffalo blower.

The next group comprises a two-horsepower 1,120-revolutions-per-minute motor belted to a 12-foot three-hanger shaft and 13 feet of countershafting, seven hangers, driving the following machinery.

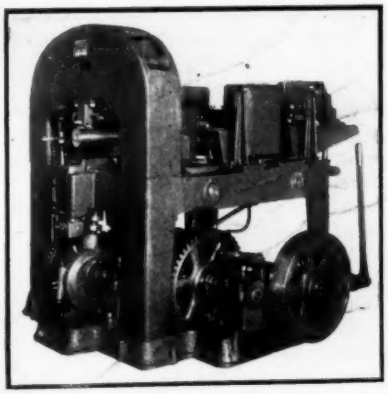
One special machine for applying soldering flux to the cans.

One United Manufacturing Company ending machine used for bending in the sharp ends of the body.

One crimping machine used to tighten the seams in the ends of the can.

Two can elevators, and one 20-foot chain conveyor for handling cans.

Group III consists of a 7.5-horsepower squirrel-cage induction motor operating at a speed of 840 revolutions per minute which is belted to an eight-foot three-hanger shaft and 43 feet of countershafting, 13 hangers, driving the following machines.



Flanging Machine.

One American 6 inch by 6 inch single-cylinder vertical air compressor having a flywheel 28 inches in diameter with a rim 5.5 inches by 1.5 inches.

One Garden City No. 2 positive-pressure blower, 156 revolutions per minute, furnishing air to a carbureter.

One single-cylinder pump for supplying gasoline to the above carbureter from an underground tank.

One Torris Wold ribbon solder maker, two 18-inch by 6-inch rolls.

One "end floater" which consists of two belt conveyors and a chain conveyor which carry cans past gas torches and a solder feed.

One can elevator.

The last group comprises a five-horsepower motor running at a speed of 840 revolutions per minute, belted to a 30-foot 8-hanger line shaft and a 15-foot 5-hanger countershaft driving the following machines.

Five Slaysman & Company cutting presses used for cutting and pressing ends of cans.

One Stevenson Manufacturing Company can-testing machine.

Commercial Practice
Management, Rates, New Business

SELLING ELECTRICITY TO LARGE USERS.

By S. N. Clarkson.

Mr. Clarkson, who is assistant sales manager of the Union Electric Light & Power Company, St. Louis, presents in this article some very valuable suggestions for central-station salesmen, especially those selling power to industrial plants. Such salesmen, to be successful, must have a capactiy for making detailed analyses of manufacturing plants and processes.

It has been said by many not in the electrical business that mere order takers could sell central-station service and that the competition and selling difficulties were not sufficient to require the services of real salesmen. Those in the business know that such is not the case, but it might be interesting to learn why these "order takers" must not only be good salesmen but engineers in the broad sense of the term as well.

Companies supplying electricity in any locality aim to distribute the energy from a minimum number of generating stations, and, as a consequence, have come to be known in the electrical industry as central stations. When most of the large St. Louis factories and skyscrapers were built, the central-station industry was in its infancy, and the owners had no alternative but to install isolated power plants to meet their requirements. Since that time, there has been a gradual reduction in the cost of purchased energy and a great increase in its use, until now the central station is in a position to advantageously serve the largest light and power consumers. At one time, many of the industrial power plants were larger than those of the supply companies furnishing service to the public in the neighborhood, but the central-station power plants have grown by such leaps and bounds that today few, if any, of the isolated plants in large cities have as much as three per cent of the capacity behind the metropolitan central stations. This is especially true of St. Louis which has unlimited fields of cheap coal and water power to draw on, and, as a consequence, has rates which compare favorably with those of Buffalo or any other city in the country.

It is only within the past two or three years that conditions have changed so materially in favor of the central station, and it is difficult for many of the isolated-plant operators to realize that the change has really taken place. A power salesman's first and often most difficult task is to make an isolated-plant operator realize the possibilities of central-station service for him, and no progress has been made towards a sale until the prospect has evinced a willingness to be shown. Interest up to the point of closing can sometimes be excited by referring to similar concerns who are well pleased with purchased power or by tactfully capitalizing special conditions at the right time. This is a good shortcut when effectively used, but nearly every man seems to think that his proposition is the first one of its kind on earth.

When a salesman's advances are met with rebuffs, it is of the utmost importance for him to know why. Many a "lost business" report has been turned into a most acceptable order by finding out the buyer's real objections and applying the correct antidote. Whatever he may say, the large manufacturer rarely has a good reason for believing that his private-plant service is more satisfactory and economical than that furnished by the central station, and the salesman must find out his hypothesis. By plying the prospect with questions and refusing to take "no" for an answer, the power salesman may learn of some peculiar condition, which makes the prospect believe the cost of central-station service to be prohibitive. On the other hand, he may say that so much exhaust steam from the engines is required for heating, and in manufacturing processes, that either the heat or the power costs nothing, because the same steam operates the engines and then furnishes the heat. Following up these admissions, a good salesman will probably soon find out that the prospect does not know the amount of energy being developed in his plant nor the amount of steam used for heating, and in a great many cases, does not even know the total power plant expense. It may seem strange that such conditions exist in modern commercial establishments, but it rarely seems to occur to the manufacturer that he should find out what he is getting for the money he puts into his power plant every year, and the natural tendency is to keep away from things one is not thoroughly familiar with.

Office buildings, department stores and hotels were for many years considered beyond the scope of the central station on account of their heating requirements. Careful investigation, however, showed that in common with most manufacturing plants, the heating requirements of these skyscrapers are heaviest in the early morning when the load on the engines is not sufficient to supply all the exhaust steam required, and, as a consequence, live steam must be used directly from the boilers. During the daytime, the electrical and mechanical load of the plant becomes heavy, while the steam heating requirements are so much lighter comparatively that much of the exhaust steam is wasted by being discharged to the atmosphere. Test curves of actual conditions showed the fallacy of the "heat or power for nothing" idea in a graphic manner, but it took years of plugging to make owners of St. Louis skyscrapers admit that they were not operating as efficiently as they thought, and that they could get better service by turning their plants over to the central station. Office buildings, hotel and department-store servic. is usually similar to that furnished by the supply company so the change-over cost is comparatively small except where old hydraulic or steam elevators are encountered.

In the industrial or manufacturing field, the situation is more complicated. In all probability, there will be a mill engine with endless belting and line shafts, or else an electrical installation which cannot be operated from the power company's service lines. As stated before, the plant owner may or may not have accurate data on his power costs, but almost invariably has no data on the power plant. He will usually take the rated engine horsepower and multiply by the hours of operation in order to determine the horsepower-hours used per year, although, as a matter of fact, the average load

on the engine may not be 50 per cent of its normal capacity. He wants to know the probable cost of electric service, but cannot give the salesman anything definite to figure on. Here it is obviously to the advantage of both parties to get toegther and find out the true conditions of the light, heat and power requirements, and it is the policy of the company, with which I am connected, to conduct complete investigations for prospective customers without putting them under any obligation to purchase service.

A prospect will sometimes give the salesman permission to conduct an investigation, and says he will purchase central-station service if he is shown that it would be to his advantage to do so. It is very common, however, for the salesman to be told by the prospect to go ahead if he so desires, but that he has invested anywhere from $10,000 to $300,000 in his power plant, which is still giving very satisfactory results, and that he absolutely refuses to even consider scrapping it and spending anywhere from $2,000 to $60,000 to re-equip his plant electrically. This is, of course, a short-sighted policy, because if an additional investment will improve manufacturing conditions and earn a fair rate of interest on the total investment, it is a good business proposition. It often takes months and even years to make a prospect see it that way, and after all the work has been done to determine the conditions in the plant, the salesman sometimes learns that plans mapped out by those in control of the business—probably in some other city—preclude the possibility of his ever getting the business irrespective of the merits of his proposition. This is just one of the tests of a salesman's optimism, and unless he has implicit faith in himself, his proposition and in all things working together for good, he can never hope for a full measure of success.

The power salesman must be able to go ahead and conduct a complete investigation of the consumer's power conditions, determine existing operating costs, recommend whatever changes in equipment may be necessary, estimate the cost of proposed changes and figure out the cost of operation with central-station service. Unfortunately, there are no text books or university courses which in any adequate manner cover the problem that is now before the salesman, so the leading central stations have had to start schools to train their own men for this work. Even with a good engineering knowledge and a fund of common sense, it requires considerable experience in estimating power-plant costs and the energy requirements of different machines before the work can be done with any degree of accuracy. To gather all the information and compile it in a suitable form for presentation may take days, weeks or months, but it is time well spent, as the salesman will have learned the real weaknesses of the old system as well as the advantage of the new.

Central-station companies usually have a number of different rate schedules for the various conditions met with in practice, but there may be no schedule which can be advantageously applied in some particular instances. When such is the case, the central station adopts the broad policy that it is better never to have had a man's business than to be unable to hold him as a satisfied customer, and advises the prospect to continue the operation of his plant until either the rates or conditions change to their mutual advantage. As most progressive business houses are growing and the cost of electric service is decreasing, it may not be very long before the apparently dead prospect will be resuscitated and converted into a new consumer, who will recommend central-station service to all with whom he comes in contact.

It must not be inferred from what I have just said that central-station service must be cheaper than isolated-plant operation in order to receive favorable consideration, because that is not so. The power required in manufacturing may only cost from 2 to 4 per cent of the value of the finished product. It follows, therefore, that if central-station service permits of rearrangements in the factory, maintains constant speeds and economizes in space, which result in an increased factory output without additional overhead expense, then the profit from the increase in output will pay for a very large increase in power costs. This is a point overlooked by the salesman who can only sell on price, as is also the fact that many manufacturers are quite willing to pay an increase over their own plant costs in order to get the service which goes with central-station light and power, to be relieved of plant worries and to permit them to devote their entire time to producing a better and cheaper article. This is an age of specialization and the time is not far distant when manufacturers will no more think of making their own power than bakers do of grinding their own flour.

The central stations have been getting practically all of their power business by going in and proving, in each particular case, their ability to reduce power costs. The time is coming, however, when the power salesman will not always be able to do this, and he will then have to devote more time and attention to increasing factory outputs with corresponding reduction in unit costs in order to bring about the universal use of central-station service.

Industrial Plant Investigation.

It is best to start an investigation by listing all the power house equipment and the manufacturing machines. It is also advisable in this connection to make a plan of each floor, showing the line shafting and the position of the machines driven from it in order that any proposed rearrangement can be more readily explained to the prospective customer. The list of equipment for both power and manufacturing purposes must be supplemented with information, giving the work done by each machine or group of machines, the hours' use per day and the particular hours of the day during which they are used. This latter information is required to determine the maximum power requirements that will have to be furnished. In finding the use to which the different machines are put, cognizance must be taken of the sequence of operations from the raw material to the finished product, so that advantage may be taken of every possible rearrangement that will tend to facilitate handling en route.

The power being developed by the engine must be determined from calculations or tests, and this will generally show that one-half or more of the total energy developed is required to overcome the friction in the engine and shafting. The amount of coal being consumed must be estimated from the work being done by the engine, while the labor, overhead maintenance, supplies and repair costs must be judged from observations of conditions. Due to the human element in operation and maintenance and to the difference in load conditions, no two plants, even with identical equipment, will cost the same to operate, and, as a consequence, it requires considerable experience and judgment to arrive at the correct cost of these items without the assistance of complete records. Next to making a correct estimate of the energy that will have to be purchased, it is most important that the power costs under existing conditions should be accurately determined. With this figure approximately correct, the salesman knows whether or not he can effect a saving, and in cases where the prospect claims to have kept a record of his operating costs, it is a means of checking those figures to see that no items have been left out.

The salesman must now decide on the size, number and location of the motors best suited to the conditions. The entire plant may be driven from one motor as in engine drive, or every machine may have a separate motor. These are the two extremes, and in practice a compromise is usually found

best in which some machines have individual motors and the others connected in groups of two or more to each motor. Just which arrangement should be recommended for each department depends on the initial outlay for motors, the price of energy, the method of operating the different machines with respect to one another and physical conditions about the plant. The capactiy of the different motors must be determined from the requirements of the machines that are operated underload simultaneously. The salesman should now be able to estimate the amount of energy his company would have to supply to meet the prospect's requirements, and having that, it is easy to supply his rates and arrive at the cost. The difference between the amount of energy to be purchased and that being developed by the engine represents the friction and other mechanical losses of transmission. Having compiled all the necessary data in a logical sequence, starting with a list of the equipment, then determining present costs, proposed equipment changes and their cost, electric energy requirements and cost and the cost of heating, it is time to compare the costs under present and proposed conditions and compile the report.

During the investigation it is advisable to keep in close touch with the man who is to pay the bill, so that the recommendations will be made in accordance with his ideas. There are many ways of arriving at the same end, and as long as the owner's wishes are not contrary to good engineering, it is always advisable to make recommendations in line with his suggestions. Every item of importance in the final report should have been thrashed out with the factory operator and owner beforehand, and, if possible, their support obtained. When this has been done, an appointment should be made to read over the entire report. As the whole thing has previously been discussed piecemeal with the prospect, he is able to understand the report without effort, and seeing recommendations, which he has already agreed to, thinks of them as his own, and looks upon the printed report as a confirmation of his own ideas.

One might think that the showing of a saving of from 10 per cent to 100 per cent on the investment would be sufficient to get the business, but such is far from being the case. There is a certain inherent inertia which induces a man to let well enough alone. Under most favorable circumstances it is very difficult to pry a steam plant away from a man and get him to invest in a new form of power upon which he has no guarantee as to cost. Prospects will often hold off and dicker for a better rate, and it is sometimes difficult to make them understand that central-station rates are fixed and under similar conditions the same to all. The central station can guarantee the cost of any given amount of energy, but it cannot guarantee the amount of energy that will be used any more than the grocer will agree to give unlimited supplies for a stated sum. The prospect may just pay for what he uses, and if he doubts the estimate of the power salesman, he can have this checked by disinterested parties. It is very easy to get highly trained consulting engineers, but it is not so easy for the prospect to find one who has had any experience in industrial engineering, so success in securing an order for central-station service often depends entirely on the amount of confidence the prospect has in the personal integrity and engineering ability of the salesman.

The actual closing of the contracts, however, requires all the enthusiastic persistency and skill that the salesman may possess, and presents the same problems that are encountered and solved by all good salesmen.

Fewer Accidents to New York Edison Employees.

The accident figures of The New York Edison Company for 1913 are now available and present some extremely interesting points in view of the employers' liability laws in New York and other states. Although the electrical industry is generally considered extremely hazardous, for the seven years ending with 1912, the Edison Company has lost less than one man yearly (killed) per thousand. In the territory under the jurisdiction of the First District Public Service Commission, the average figure for the years 1909-11 was 1.9, while in the Second District it was 5.3 during this corresponding period.

The total number of cases, 1,748, reported by the New York Edison Company is high because the company's safety system requires the reporting of every accident and mishap, no matter how trivial. Of the 1,748 cases on record, 1,024 represented no loss of time whatsoever; 364 injuries caused the loss of from one to three days' time; 139 meant one to two weeks lost; 40 cases two to three weeks; 19 cases three to four weeks; 15, four to five weeks; eight, five to six weeks and only eight cases eight weeks and over.

Time lost by the entire accident and disability list for 1913 was 5,308 days or fourteen years, six months and eighteen days. This is a great improvement over 1912 when the entire time lost was 22 years, 3 months and 9 days. The average time lost per case reported in 1913 was 3.04 days, while in 1912 it was 4.5 days. The entire cost of all accidents is met by the company, which nevertheless records the accidents as due to various causes. Of the total number reported, 1,516 resulted from negligence on the part of employees; 86 would have come under the old "fellow-servant" clause; the company was liable but for 123 and outside contractors for 23.

It is also interesting to note that the cost of careless accidents is still the highest per case; those classed as due to a "fellow-servant" have decreased in cost since 1912, as have also those for which the company is liable and those from purely electrical causes. Of the 123 accidents for which the company was responsible, only eighteen were due to electrical causes.

Such a record is the result of the company's earnest and persistent carrying out of a system inaugurated back in 1905. By this arrangement, as already pointed out, the company not only does its utmost to protect the men from accident, but assumes full responsibility whenever any such unfortunate occurrence takes place.

House-Wiring Campaign in St. Louis.

Liberal space is being used by the Union Electric Light & Power Company, of St. Louis, in all of the daily newspapers to advertise the house-wiring plan which the company has recently inaugurated. A base rate of $17.95 for the wiring of a five-room house, with one outlet in each room, is inducing many of the small residence owners to avail themselves of central-station service and the company reports that much new business is being obtained.

A charge of $1.80 is made for each additional outlet and fixtures are provided for as low as $0.70 each. The payments for wiring are spread over 12 months.

Puget Sound Company Acquires Plant at Buckley.

The Buckley Electrical Company, of which E. F. Osberg has been president and which had a 50-year franchise at Buckley, Wash., has been sold to the Puget Sound Traction, Light & Power Company. The business will hereafter be handled through the Seattle office of the latter company.

The Puget Sound Company has completed a 13,500-volt transmission line from the White River power plant at Dierringer, a distance of about 14 miles.

The Puget Sound Traction, Light & Power Company has closed a contract with the City of Everett, Wash., to light that city's streets with Mazda lamps. No arc lamp will be used whatever.

Electric Sign Data

Spectacular Electric Sign in Cleveland.

The sign photograph reproduced this week shows a spectacular electric sign recently erected by the A. & W. Sign Company in Cleveland, O. The flasher, which in this case has so much to do with the effects produced, is also reproduced, this being of Betts & Betts manufacture.

This sign is very similar to the one built by the Thomas Cusack Company in Indianapolis for the same people, which was operated by the same type of flasher. The sign is approximately 35 feet by 55 feet and contains about 2,000 lamps.

The action of the engine, like that of the Indianapolis sign, is very unique. The engine outline, wheels, and track come on, remaining stationary for a moment, then the wheels begin to revolve. At the same time the smoke rolls up out of the stack in regular puffs. It comes on a few lamps at a time and has the effect of drifting back to the letters "Choo Choo," which are brought on one at a time. The wheels and track continue speeding up to a point where the train appears to be running very swiftly. After this the words "Mail Pouch" come on, and then the line reading "The Chew To Choose."

The speeding-up effect is accomplished by the use of a secondary motor and resistance coil, as will be noted by close observation of the flasher photograph.

The smoke forms are produced by a special form of wiring and lamping which gives the effect of rolling, waving smoke, which made the first one of these signs in Indianapolis famous. The smoke has the effect of puffing up out of the stack, spreading, waving, and rolling back.

When a sign manufacturer of ability has the co-operation of a flasher manufacturer with an engineer who is capable of developing each little detail as in this sign, it is a very simple matter to reproduce naturally moving effects.

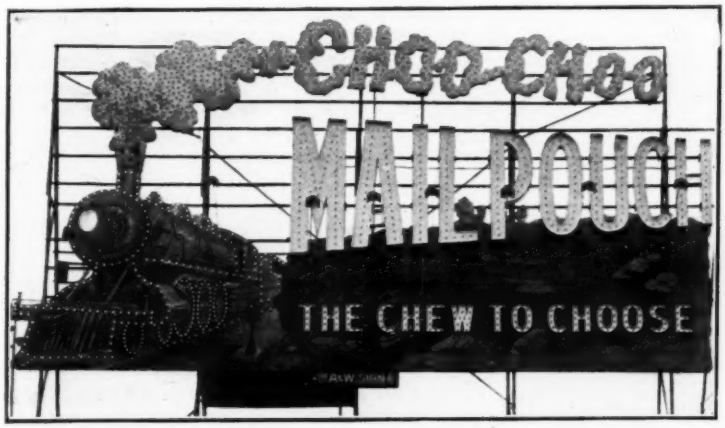
One of the features of the electric sign campaign being carried on by the Toledo (O.) Railways & Light Company is the publicity given to each new sign customer. Much of the success of the campaign is attributed to this feature.

As soon as a sign is in operation a photograph of it is taken and published in the daily papers, advertising both the electric service and the place of business of the newly acquired sign customer. Distinctive signs are sold in all cases, the company operating on the theory that one original clever design helps to sell other signs to the competitors of the first purchaser.

Energy for sign lighting is sold on a flat rate, 9 cents per lamp per month, this price including lamp renewals, and all other necessary maintenance. The most effective talking point used in connection with this rate is the hourly cost of operation of the signs which the prospective customer seems to favor. This figure is usually considerably less than a dollar for an average sign, and such an advertising rate appeals to the merchant as low in comparison with other advertising mediums.

A census of the signs thus far erected shows that the average sign contains about 250 10-watt tungsten lamps.

The City of Sacramento, Cal., has recently acquired an effective slogan sign which greets the traveler as he nears the city. The display consists of a large red heart enclosing an outline of the State of California marked in natural lamps. Within this outline, the position of Sacramento is indicated by a small red heart. A flasher operation makes this sign very conspicuous and impressive, and with it comes the message, "Sacramento the Heart of California. Ask the Chamber of Commerce."



Electric sign, with flasher, installed in Cleveland, O. Sign manufactured by A. & W. Sign Company, Cleveland, and the flasher by Betts & Betts, New York.

Sign measures 35 feet by 55 feet. There are 2,000 five-watt lamps.

Full details of flashing effect and color scheme are given in accompanying text.

Electrical Construction

ELECTRICAL INSTALLATION FOR CHILD'S RESTAURANT, LOUISVILLE.

By F. F. Valinoti.

This is the first installment of what it is proposed to make a progress report upon the installation of the wiring for the lighting and power equipment of Child's restaurant, Louisville, Ky. The building, which is an old one, is being remodeled, and the electrical work is under the direction of the Harry I. Wood Company, of Louisville. As the work proceeds, Mr. Valinoti will decribe in detail the methods of handling the various phases of the work involved.

The specifications call for a complete conduit system for both power and lighting, the conduit for first floor to be concealed, and the basement conduit to be run exposed. The building is an old one, which is being remodeled. It is 50 feet wide and 110 feet deep. The height of the first-floor ceil- is 18 feet.

Fig. 1 shows the location of the various outlets on the first floor. The floor construction is of wood, the joists being placed from I-beam to I-beam. The I-beams run across the building, while the wooden joists run longitudinally.

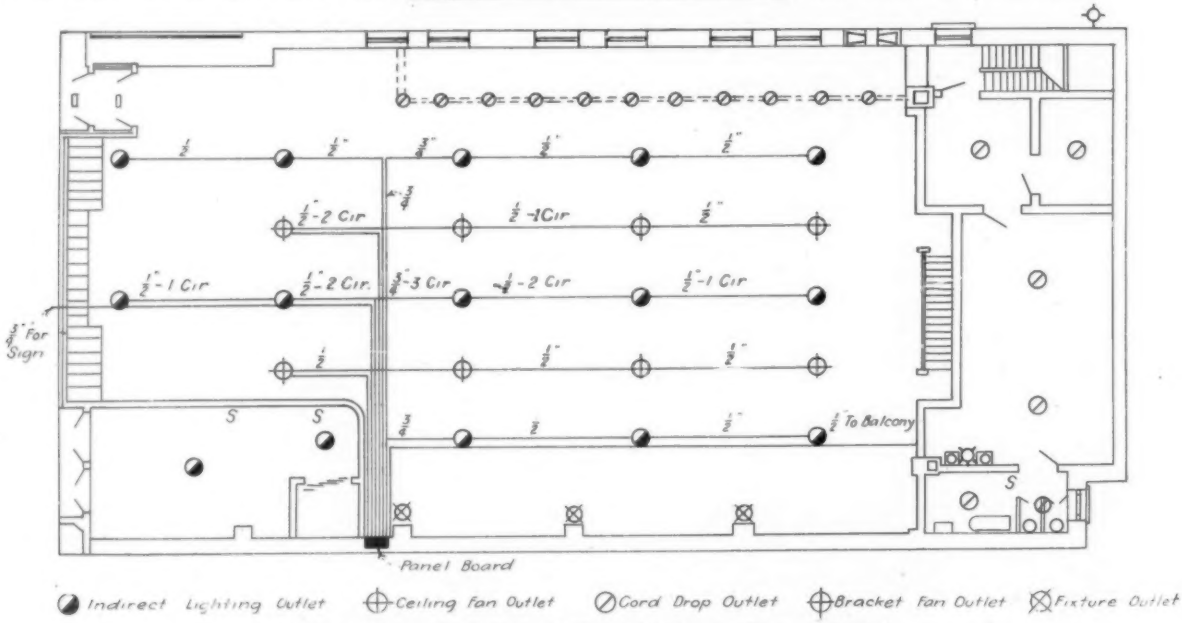


Fig. 1.—Plan of First Floor, Showing Outlets and Runs of Conduit.

The floor of the second story was taken up the full length of the building, in sections 30 inches wide. This gave us an opportunity to run the conduit between the two joists from one end of the run to the other, without using any flexible conduit, or fishing.

Fig. 2 shows the manner of running these conduits. From each longitudinal run a three-quarter-inch conduit was taken across the top of the joists, which were notched, over to the wall, and then down to the cabinet. A piece of 2-by-6-inch plank was nailed between joists to support each outlet box.

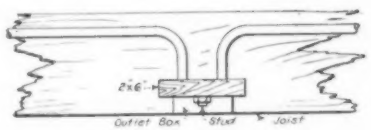


Fig. 2.—Mounting of Outlet Box.

As a few of the wire manufacturers have now paced on the market a No. 14 duplex wire, which has a very tightly woven braid, and is therefore smaller, we have pulled two circuits of it in the half-inch conduits, and three circuits in the 0.75-inch conduits. This was done also to keep down the running of a great many half-inch conduits, which would require more space and notching of joists. This new duplex works very well in the above combination, as it can be pushed from outlet to outlet very easily. We also find, from a standpoint of cost, that running three circuits in 0.75-inch beats four circuits in 1-inch conduit.

There are eighteen circuits supplying the ceiling, divided as follows:

One circuit to each individual fixture.

One circuit to two ceiling fans.

One circuit to balcony lights.

The circuit feeding the drop lights under the ventilator balcony on north side will be taken from the cabinet, across the basement ceiling, and up the north wall to a point seven feet above the floor, then around under the edge of balcony, condulets being used for each drop. This circuit has not been installed at this writing.

It required 180 feet of three-quarter-inch conduit, and 570 feet of one-half-inch conduit to rough in the first-floor ceiling. The labor required amounted to 36 hours each for wireman and his helper.

This, however, does not include the taking up of floor, which was done by the carpenter contractor.

The south wall of building, which is of brick, was cut to receive the distribution cabinet, which is 24 by 57 by 4.5 inches. A channel 6 by 4 inches was cut both up and down from this point for the reception of the branch-circuit conduits, and the feeder conduit, which will be brought across the basement ceiling and up.

The Percentage System in Electrical Contracting.

By G. D. Crain, Jr.

With an Expression of Opinion Upon the Subject from Several Leading Electrical Contractors.

One of the most important and interesting developments in the electrical contracting business, as in other departments of building construction work, is the use of the percentage system. As the name suggests, this plan involves awarding business to the contractor on a basis of an agreed percentage above the cost of labor and materials.

The defects of the system of bidding are obvious. In the first place, there is an element of uncertainty which sometimes results in the contractor handling an important job at an actual loss. Unforeseen elements of difficulty may arise, and the delay and increased expense thus made necessary eliminate all possibility of earning a profit.

The average owner is willing that the contractor make a fair profit on his work; and it is also plain that if a contractor sees that he is likely to lose money on a job he will be tempted to "cut the corners" wherever possible for the sake of making his net loss as small as possible. This does not always happen, of course, for many concerns would rather lose money on a piece of work than risk losing the good-will of the customer. Nevertheless, the temptation to slight the quality when it is found that a bid which is too low to cover the cost has been made, is present, and it doubtless has its effect in a good many cases.

On the other hand, the very fact that the wise contractor appreciates the risk involved in bidding, since it is never possible to anticipate every feature which may arise, means that a larger margin must be allowed to take care of the unknown quantities than would be necessary if every point were covered by the bid. The contractor who would be willing to make 15 per cent "for sure" on every job will probably allow 25 per cent in bidding in order to cover the unexpected difficulties that may arise, and also to take care of other jobs where the net had been considerably below the expected profit.

That means that in some cases the owner pays more than a fair price for the job. He is helping to average up the general run of work, and his excess payment offsets the too small amount charged on an unprofitable job. This is obviously an inequitable system, and furnishes a legitimate argument for the use of the percentage system.

One of the chief advantages to the contractor is that he can get the benefit of accumulated good-will and the prestige which goes with a record of big jobs well handled. While it is not necessary that the architect let the contract in every case to the low bidder, the inclination is always in that direction, and thus the inexperienced and the unskilled, who know neither how to figure the cost of a job nor how to handle it to the best advantage, are likely to get work to which those who have proved themselves in previous jobs are really entitled. That is one of the glaring weaknesses of the present system. The lowest and best bidder is the man to whom the contract, in theory, should be awarded, but in actual practise it is the low man more often than the best who gets the business. Contractors have learned this, and know that only when their bid is pretty close to the bottom will they be given serious consideration.

The percentage system eliminates all this. It puts a premium on efficiency and high-grade work. If the Johnson Electrical Company did an excellent piece of work in wiring a storeroom for James Martin, architect, and Mr. Martin has another job in which particularly careful work is required, he would much rather be sure of Johnson getting it, by making a percentage agreement, than have to take bids and feel called upon to let the contract to the low man, irrespective of his previous record, and without regard to whether the architect himself had tried him out on other work. That makes the percentage plan easy and convenient for the architect.

Then, too, many an owner has a friend in the business whom he would like to favor. Under the open bidding system he does not feel justified in apparently throwing away money merely to favor a friend. Consequently if somebody else bids lower than the concern he is acquainted with, it is seldom he interposes a request to give the contract to the higher man. With the percentage system, he can do this without feeling that he is making the job cost him more than a fair price. He is sure of getting it at a proper charge, for labor plus material plus profit should be easy to figure.

It must not be thought, however, that the percentage idea solves all problems, and makes life's path easy for the contractor. There are difficulties and irritations involved here as well as under any other system, for no change in methods will change human nature. The contractor who is inclined to beat the owner under a bidding system will probably attempt the same thing under a percentage plan.

In fact, cases have been cited in which the contractor padded his expense bills, charging the owner the list price for material, without showing the discounts received. Time for labor was also increased, helpers being put in at mechanics' prices, and other features of that kind developing. Carelessness in buying and using material when the owner is footing the bills is also apparent in some jobs handled on a percentage plan, and when this occurs the system is given a bad name.

Another difficulty is determining just what the percentage should be. And, after all, here is an opportunity for bidders to be pitted against each other, for the man who agrees to do the work for the smallest percentage over and above the cost of the material and labor, other things being equal, is likely to get the job. So adopting this plan does not entirely solve the problem, by any means.

One large contractor in an Ohio Valley city believes that 20 per cent, plus a proper charge for supervision, is a fair basis on which to handle the business. He points out that he is entitled to a profit both on the material used and on the labor supplied, and that it likewise costs money to have

the work properly supervised, supervision not being included in the labor item, as a rule. But sometimes he finds that other contractors are willing to eliminate the supervision charge, and also to shrink the percentage of profit, the incentive to the man who has no very high principles for the conduct of his business being so obvious that a good many of them will take the work for almost nothing in order to have an opportunity to make money by "faking" their bills.

"The percentage plan has been given undeserved unpopularity among certain owners and architects," said the head of the concern referred to above, "because of their experience in dealing with contractors who did not play fair. It might be said that under such a system the owner would be foolish to give his work to anybody except those he knows he can trust completely. But if one man is willing to work for a smaller margin of profit than another, he is likely to be given the work. The contractor of this kind may think that it is legitimate to make up for a narrow margin of profit by padding his bills, and get his profit in some other way; but we believe in laying all our cards on the table and stating in the beginning just what the charge is going to be, above the cost of labor and material."

A phase of the plan which seems to meet the objection that the contractor has no incentive to work out effective methods of cutting costs and reducing the expense of a job, in view of the entire cost being borne by the owner, is the award of a bonus. The architect figures an estimate, which is agreed upon as representing the probable cost of the job, and the contractor gets 50 per cent of any saving made in the work compared with the original estimate. This makes it worth the while of the contractor to reduce the expense wherever it can legitimately be accomplished, and gives him something to work for. This plan has been used successfully in a good many cases.

The percentage idea is undoubtedly interesting. It has its defects and drawbacks, but appears on the whole to mark an improvement over the typical system.

Ernest Freeman, President of Freeman-Sweet Company, Chicago, and President of the National Electrical Contractors' Association.

"The Percentage System in contracting, in my opinion, has no virtues and many defects. It does not eliminate competition, nor does it insure superior construction to an owner; but it does invite, or at least tempt, unscrupulous business methods on the part of the contractor. In a very large majority of cases, no matter how large or how small, *work* costs more than the purchaser thinks it should, and *settlements* often cause loss of money and friendships as well.

"For my own part, I would rather have a definite contract, carrying clearly defined obligations from both parties, with a predetermined price, than a percentage plan which is definite in no particular."

J. T. Marron, President Electric Construction and Machinery Company, Rock Island, Ill.

"About half our work is done on the percentage basis, and we find it works out very well.

"Referring to the last paragraph; we have also done considerable work under the fixed-sum basis and division of the savings. This is really the proper method of working. The contractor gets further pay for a special effort to hold the cost of the job down. The cost of promiscuous figuring on electrical plants is no small part of the contractor's overhead, and if there was more work done on the fixed-sum or percentage basis, the work could be done more cheaply for everybody concerned."

John C. Hatzel, President Hatzel & Buehler, New York.

"Personally I favor the Percentage System and in my opinion it is the ideal system for all concerned, including Owner, Architect, Engineer and Contractor.

"Mr. Crain sets forth both the advantages and disadvantages of this system; but it simmers down to awarding the work to an absolutely reputable contractor in whom the owner and architect have confidence. With the almost universal present-day system of placing electrical construction in the hands of a general contractor, abuses have crept in, which doubtless would be remedied by letting the work on a percentage system directly by the owner.

"Under the present system, the general contractor, with few exceptions, obtains numerous bids from electrical contractors indiscriminately, irrespective of their financial responsibility or otherwise; using the lowest bid, and even shading this in his estimates. Then he peddles the electrical work on the basis of a lower price than even the lowest bid, a competent and responsible contractor possibly being given the preference at the lowest possible figure. The result of this system has been exceedingly keen competition; work awarded at a price below actual cost, with the consequent lowering of the quality of the work; the contractor, naturally, also endeavoring to make up his loss or increase his possible small profit by overcharges on changes and additions which may occur.

"Under the Percentage System, these abuses would be remedied; the contractor would obtain a fair profit on his work, and the owner would obtain proper results and the full value for his money.

"The percentage over cost allowed the contractor on such a basis, of course, cannot be definitely established, this depending to a great extent on the localities, the average volume of work of the contractor, etc. On the net cost of labor and material, a fixed percentage should be allowed for administration expenses and supervision; this percentage, plus the net cost of labor and material, being considered the net cost of the work to which a percentage of profit should be added; this percentage, as before stated, depending on the locality and the size of the installation, or in other words the cost."

Joseph Fowler, President of the Jos. Fowler Electric Company, Memphis, Tenn.

"Theoretically the idea presents an utopian solution of some of the ills of electrical contracting. In practice I think it would fail utterly. Mr. Crain has given the best reasons why this plan will never be in general use.

"Primarily, the suggestion is offered as a preventative against the gambling propensity so prevalent in the electrical contracting field and as a safeguard to the buyer of electrical contracting. Mr. Crain proves that the probabilities are that it will do neither of these two very important things.

"Possibly the most noticeable failing among electrical contractors is their ignorance of overhead cost, and, if this be true, a competition on the basis of percentages would be as disastrous as the present method. What would prevent a contractor whose overhead is 25 per cent, but who knows it not, from bidding to undertake a commission at a gross profit of 10 per cent? It has been my experience that where a buyer is inclined to favor the percentage plan he first wants a guaranteed maximum cost. This is far worse than a flat bid and all the odds are in favor of the buyer.

"Again, the plan does not protect the buyer beyond the honesty of the contractor. As the author has pointed out, many contractors would deliberately estimate the percentage low with the intention of either slighting the work or manipulating the cost sheets or both.

"My concern would welcome the adoption of the percentage plan if the buyer could be brought to recognize

our 25-per-cent overhead cost and our need for a 10-per-cent margin of profit. In the settlement of a recent commission of this sort we had difficulty in making plain to the owner that the 25-per-cent overhead was computed on the selling price and not on the labor and material cost of the work.

"The frailty of human nature is an insurmountable obstacle to the feasibility of this very excellent suggestion.

"How awful it is that contractors will persist in trying to fool themselves that they have no overhead, or of just simply putting their overhead at 10 or 12 per cent without looking the facts squarely in the face. We have all seen contractors figuring on how to charge this and that item to some other account rather than put it where it legitimately belongs—'The Overhead.' I think a lack of knowledge of a correct overhead rather than an incorrect estimate of labor and material cost is responsible for most of the losses in our business. It seems strange that the buyer who is, of course, a business man in some other line should turn pale when you talk to him about overhead. Surely he must be acquainted with the 'animal' in his own business. He demands that you keep an accounting force to keep track of the details of the work you are to do for him. He insists that you have a place of business and a telephone so that he can keep in touch with you. He forces you to advertise before he will recognize that you are on earth. He knows that you are not a very responsible concern if your establishment is not well lighted, heated and ventilated. He will not receive you in his office if you do not present a respectable appearance. Taken together what do all of these things constitute but overhead?"

R. G. Littler, President West Coast Engineering Company, Portland, Ore., and President Oregon Electrical Contractors' Association.

"This is a matter to which I have given considerable thought, and with which our firm has had a great deal of experience in actual practice. With all due respect to the author of the article, I wish to state frankly that it is good as far as it goes, but I do not think it comprehensive enough for such a subject, as it does not go into enough detail.

"Most of the work which our firm has undertaken on percentage basis has been with firms who have had the greatest of confidence in us, and I will frankly state that we do not want any percentage work under any other circumstances, as in any other case it is the most undesirable business that a firm could possibly take upon itself.

"In the first place, the basic principle of percentage contracting is for the owner or client to know absolutely, that he is getting the labor and materials at absolute cost. If he is not in a position to assure himself of this, and does not know that the integrity of the contractor is unquestioned, then he had better not enter into a percentage agreement, for the reason, as stated above; that is, the first principle is lacking.

"Another question: 'Is the owner entitled to the very best quantity price which the contractor is able, by his purchasing power, to get on the materials?' For instance, a contractor may buy his conduit by the carload, getting the best price there is to be had. 'Is the owner entitled to have advantage of this price, if his particular job requires the use, we will say, of only 5,000 feet?' I claim he is not entitled to any price except that which his quantity will command, for the reason that the contractor has bought at a carload price, has furnished the money to carry the conduit in stock, and is entitled to a return on that money, and that the goods should be sold by him in a percentage agreement at the price that each particular quantity commands.

"Another mistaken idea in percentage work is that a great many such agreements are made with a saving clause for the owner, in which the contractor guarantees that the work to be undertaken will not exceed in cost a certain fixed sum.

"Contractors who take work on percentage basis on such terms as this are making a great mistake. It amounts to nothing more or less than a contract with the added pleasure of the contractor assuming additional risks and giving the owner all the advantages. It seems to me that, when an owner asserts his willingness to award work on percentage basis, that he takes the stand that he is ready to take a contractor's chance, you might say, on saving money over what the work may have cost him had he let it on a contract basis. If he is dealing with a contractor whom he knows is honest, he knows that his work can only cost him in direct proportion to the cost of the labor and materials, plus the percentage agreed upon, and he knows that he will get a square deal. As I have stated before, if he does not know this as a fact, then there should be no percentage agreement made, for it will surely be unsatisfactory to one or both parties to the deal. The point I desire to submit is that the owner, under a percentage contract, should assume his share of the risk, which he can safely do if he knows his contractor, with the added advantage that if he orders any extras during the progress of the work, such extras will only cost him in proportion to the original agreement.

"In conclusion, I wish to say that regarding the amount of the percentage, this is a point which will be governed entirely by local conditions, the overhead expense of individual contractors, the efficiency of the organization, and many other points.

"It is for each contractor to figure these things out and when taking work, either on a percentage basis or otherwise, to be sure he is making a reasonable profit on his work."

J. C. Sterns, President J. C. Sterns Electrical Company, 259 Pearl Street, Buffalo, N. Y.

"I have taken the position as opposed to the percentage system on the ground that in most cases that are known the original cost of labor and material has been padded, and the owner or architect deceived. If one firm were to offer to do this work at 15 per cent above cost, and another 25 per cent, undoubtedly the man bidding 15 per cent would get the job. The man bidding 15 per cent intends to pad his, while the other does not. How is the owner going to know this? We have taken several jobs on a percentage basis, adding 25 per cent to our cost, but found in every case the owner was dissatisfied and the job would run more than we thought it was going to.

"For my part, I prefer a contract and add a fair profit to the same, and know what you are expected to do, and do it. This is my view of the percentage system."

Marshall L. Barnes, President Barnes & Payton, Troy, N. Y.

"Regarding the article written by Mr. Crain would say that if his ideas could be carried out, it would be a boon to the contractor. If a man could go on to a contract with the assurance that he was going to come out with from 10 to 20 per cent ahead on a job, he would surely feel that he had not missed his calling. The greatest trouble is that the contractor is so anxious to win out, that he too often takes a contract at pretty nearly cost with the expectation that he is going to make up on extras, but too often the owner will ask for figures from a half dozen contractors for the extras and another man is liable to come on the job and the original man steps out worse off than if he had kept off entirely.

"A man can be dishonest in anything, and could be on the percentage basis, but my idea is that it would tend to make him honest and furnish the proper material and labor, when he knew for a certainty that he was sure of the agreed percentage and could

count the dollars that would surely be his at the end."

F. M. Grant, President The F. M. Grant Electric Company, Cleveland, O.

"Many of the jobs under my supervision have been done on a percentage plan and these jobs we can point to with pride, not only with regard to the quality of the work, but it is a fact that the customers were always satisfied. Many of the customers repeated their orders and were well satisfied with their bills.

"As to the rate to be charged, I would say that it should never be less than 25 per cent above invoice cost, this to cover overhead and profit.

"The main things to be borne in mind in doing percentage work are service and quality. No one objects to paying a fair profit if he gets prompt service and good material. It is seldom that one gets more than he pays for, and if the contractor's bid is below that which will bring a profit the customer is most often the one to suffer. The percentage plan, if faithfully carried out, assures the owner of a better and cheaper job, as the best is the cheapest in the long run, but unfortunately this system has been brought into disrepute by unscrupulous contractors.

"I would not recommend a bonus in connection with the percentage system, as it appears to me that this would lead to cutting corners. A straight percentage plan with no fixed limit allows the owner to add to or deduct from his original plans, and there are no resulting squabbles over extras or deductions."

C. E. Stapp, Peoria, Ill.

"Approximately 80 per cent of our business is done on the time and material system, or percentage basis. We believe that it is one of the fairest ways to do business, but, of course, you have to be equipped with an organization, particularly as regards the men employed, that will work in such a way with you as to make the proposition a fair one.

"If the electrical contractor today would give a little more attention to figuring out the best possible installation for a lighting equipment and for the distribution of power feeders, and spend a little time with the owner as a salesman instead of devoting so much of his time to scaling down the figures on the job, he would be a great deal better off. A job without a profit is a loss to any contractor.

"If the contractor will interest the owner in getting a good job done and convince him that he will work to the best advantage possible and charge him only for labor and material, according to the quantity purchased, he will come out all right.

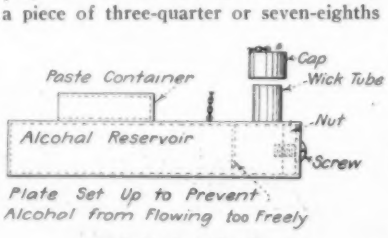
"It is often the case that when the job is a large one the contractor may need some of the money before it is completed. We never make out a bill until we are through with the job, although we may ask the owner for a part payment. When the work is completed we figure up the material and make him the best possible price on the quantity-used basis, with a reasonable excess for overhead expense and a margin of profit.

"If some of our contractors would not run after a job so hard, particularly when they find another contractor is figuring on doing it on a percentage basis, I believe we would soon have most of the good work being done in that way. But, one of the worst evils we have to contend with in this class of work is the competitor who is always trying to get in on somebody's work and make it as unpleasant as possible for the man wanting to do a good job, giving the owner, incidentally, an opportunity to feel that when he makes a fair proposition to the legitimate contractor he is getting beat.

"Another thing. Something like 50 per cent of the jobs that are being installed today are not adequate for the building they are put in and the service that will be required of them. The contractor has a fine opportunity to convince the owner with regard to the proper number of switches and plug openings. He should show him fairly and squarely the advantage it would be to him to get a complete installation as an original proposition rather than put in a system that is going to be short of his actual requirements and saddle him later on with a heavy expense for an installation after the building is completed."

A Convenient Soldering Torch.

For some time I have been using an alcohol torch, which I find very convenient for light soldering, such as fixture wire, Nos. 12 and 14 gauge copper, etc. It is made as follows. Take a piece of three-quarter or seven-eighths inch square brass tubing about six inches long and in one end (about one-quarter inch from the end of the tube), solder a good-sized nut, into which may be fitted a screw which may be removed for filling the torch, and close up the other end entirely. On the side of the tube at the filled-end, drill a hole large enough for soldering in a gas tube about 1.25 inches long for the wick tube. Another gas tube with the outer end closed, may be slipped down over the wick, making a liquid-tight joint, when not in use.



Soldering Torch.

Fasten this cap to the torch with a small chain to prevent losing it. This torch may be carried in the pocket conveniently and when laid on top of a step-ladder does not tumble off easily. In addition to this I use another short section of tube, open on one side only and soldered fast to the torch, for a container for soldering paste.

W. H. Best.

Among the Contractors.

The firm of R. W. Keck & Company, of Allentown, Pa., has been handling an increasing number of electrical contracts to the mutual advantage of all parties concerned. Among these is the installation of 30 motors in the large planing mill of the Butz-Frederick Company, also the wiring of the handsome new store of the J. M. Grimley Company. During the three years that the firm has been engaged in electrical construction, it has built up a very attractive business, chiefly due to the personal attention that Mr. Keck has given to each job, small as well as large. Scores of new houses have recently been wired by Mr. Keck's men.

The Independent Electric Company has been awarded the contract for the electrical wiring of the warehouse now being erected by the Continental Oil Company at Salt Lake City, Utah.

In addition to its regular electrical contracting, supply and fixture business, the Electric Supply and Fixture Company, of Walla Walla, Wash., has recently added an engineering department in charge of G. B. Dunmore. This department will specialize in the installation of complete lighting plants of water, steam and gas-engine driven types, as well as pumping, irrigating and water-storage systems. The many large and prosperous wheat ranches in the vicinity of Walla Walla make this an attractive field for such business.

Electrical work, amounting to $900, for the Stanton Prentice $60,000 fireproof residence, at Columbus, O., has been let to Erner-Hopkins Company.

The Cortlandt Engineering Company, New York City, has been awarded the contract for electrical work in the new ice-cream manufacturing plant to be erected at Perth Amboy, N. J., by the J. T. Castles Ice Cream Company, Newark, N. J.

George W. Hill.

No one can gainsay the fact that within very recent times the electrical contracting business has been greatly improved, due almost entirely to initiative and effort from within. The notable work accomplished by the National Electrical Contractors' Association in putting the business on a business basis and in educating the members of the electrical contracting fraternity to look out for themselves while giving their clients and customers a square deal, is something that has not been paralleled in the development of an industry.

In carrying on the work of the National organization a good deal of the responsibility for its success has fallen upon the shoulders of its special representatives, whose function and duty it is to travel over the country instructing the member as to the value of membership in the Association, describing the advantages accruing therefrom, and acting generally as a diplomatic agent between the contractors themselves and between them and the other elements of the electrical industry.

The present special representative of the National Electrical Contractors' Association is George W. Hill. Hill is by talent and temperament well fitted for the job. His boyhood days were spent on a cattle ranch in western Nebraska, and with his father he was for a number of years in the stock-raising business in Nebraska until about 17 years ago when he sold out his interests and went to Illinois. His first employment in the electrical business was with W. R. Robb & Company, Rock Island, Ill. Hill afterward got a job with the Electrical Construction & Machinery Company, the head of which is J. T. Marron, one of the most favorable known and best liked men in the electrical business. Marron must have been mighty good to Hill, for what Hill has to say about Marron's fine qualities would fill a book. Mr. Hill rose from journeyman electrician to the position of superintendent of construction. While in charge of construction for the company he had a great deal of experience in the installation of large isolated plants, such as the locomotive works of the Rock Island Railway at Silvis, Ill.

As an employee of the electrical contractor, Mr. Hill states that he always believed that the contractor has a hard row to hoe. He also had an abiding faith that the time would come when the electrical contracting business would occupy the dignified position in the commercial world which it seemed entitled to possess. He believes that in the past the electrical contractor was the poorest paid man in the world for the amount of brains and energy required to conduct his business. Always a close student of conditions surrounding the business, he has felt confident that sooner or later the contractor would come into his own.

Hill is a believer in a big way in anything and everything that has for its object the betterment of conditions among the electrical interests. While about 90 per cent of the electrical contractors have arisen from the rank and file of the journeyman electrician, it is through intelligent co-operation and affiliation with one another that the business is being promoted as a commercial institution rather than merely a trade. Hill is a strong exponent of the idea of business and professional men belonging to some association that is working for the betterment of

George W. Hill.

conditions in the particular line of business in which they are engaged. For this reason the electrical contracting business is 100 per cent better than it was five years ago, and there is no question in his mind but that this condition has been brought about through the National Electrical Contractors' Association, the spirit of Jovianism and the influence that the electrical journals have had in promoting this spirit.

As we said before, Hill is fitted by talent and temperament for the job. As he views it himself, a representative of an association of this kind must be a good fellow—not too good, but just average good fellow. He must have had experience which will place him in a position where he can realize what the other fellow is up against. He must be a diplomat—not too much of a diplomat, but possess just average diplomacy. He must be progressive, and he must be willing to take a long chance to boost the other fellow's game. He should be a Jovian, a bookkeeper, an accountant, entertainer and electrical contractor, a journeyman-electrician, a helper or a cub, an engineer, and a mixer—but not of drinks.

Hill travels among the electrical contractors of the United States, helping them to form state and local associations, assisting them in getting the co-operation of other electrical interests, explaining books and forms recommended by the Association, and in many cases adjusting differences between them and fostering a proper spirit of harmony and good-fellowship. With the talent and the temperament, and the persistent desire to work hard and make good on the job, Hill finds that this is the most gratifying work that he has ever attempted, and hopes that he may remain in it until he can see the electrical interests of the country welded together as one great happy family.

Certificate Required in Kansas City.

An ordinance has recently been passed in Kansas City, Kans., through the efforts of the local association of electrical contractors, which requires that master electricians and journeyman electricians shall pass an examination and receive a certificate before they shall be permitted to engage in electrical work.

The Board of Examiners is to consist of three members, one of whom shall be the city electrician, the second a master electrician, and the third a journeyman electrician. The two latter are to be appointed by the Board of Commissioners for terms of two years. The fee for an examination and certificate for master electrician is $5.00, and for a journeyman electrician, $2.00.

A penalty of $100 is provided for a violation of the ordinance.

Georgia Contractors' Association.

A meeting of the Georgia Electrical Contractors' Association was held at Atlanta, Ga., on April 15, and the following officers were elected.

President, R. M. Walker, of Rome.
Vice-president, H. E. Lowe, of Macon.
Secretary, J. M. Clayton, of Atlanta.
Treasurer, W. L. Bailey, of Atlanta.

It was decided to hold another meeting at Macon on May 26, when delegates to the national convention will be selected.

The Prinz Electrical Company, of Walla Walla, Wash., is just completing the contract for the entire rewiring of the Walla Walla Hospital.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

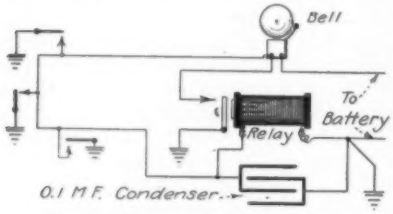
Testing Gas-Lighting Circuits.

In testing for a ground on an electric gas-lighting system, I disconnect the wire from one side of the spark coil and tap it against the terminal from which it was disconnected. If there is a ground on the system there will be a spark each time the wire is touched to the terminal, but if there is no ground there will be no spark.

M. J. Moriarty.

An Efficient Burglar Alarm.

The diagram which is given herewith shows an excellent scheme for a burglar alarm, especially when the alarm and the building under protection are separated, and the use of exposed line wires imperative. The relay shown should have a resistance of 500 to 1,200 ohms. The first cost is low, as is also the maintenance cost. Its advantages are: only two line wires are required, with the most simple type of alarm contacts; minimum operating current is required; and the cutting or grounding of either, or both, wires will cause an alarm to sound. Twisting the line wires together will not prevent operation.



Connections for Burglar Alarm.

H. E. Weightman.

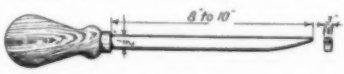
Overcoming Failure of Rheostat Handle to Fly Back.

Sometimes in the case of an ordinary direct-current starting rheostat the retaining magnet will not let go of the handle when the current is turned off and the motor stops, due to the fact that the iron retains sufficient magnetism to hold the handle, although the spring may be comparatively strong. To overcome this defect, file a fine slot in the retaining arm where is comes in contact with the magnet, or cover it over with a coat of paint. Both of these schemes work well in practice and the possibility of damage to the rheostat and motor due to failure of the rheostat handle to fly back is thus avoided.

Roy Dean.

Armature Coil Lifter.

In the course of my experience on armatures, I have often had occasion to lift one side of a number of good coils in order to replace one or more bad ones; and on account of the difficulty of doing this without injury to the good coils, have often been compelled to replace coils which, but for the injury done in lifting them, were perfectly good. As a result of my observations in this line, I devised the tool shown in the accompanying illustration, which I have found very convenient in armature work, not only in lifting coils, but in forming and packing the end connections and in driving them into place in the slot. As can be seen in the figure, it is simply a piece of flat tool steel about $\frac{3}{16}$ by $\frac{1}{2}$ inch, with one end shaped to fit in a handle and the other tapered an indicated. All corners and points are nicely smoothed with fine emery cloth to prevent cutting the insulation of the coils.

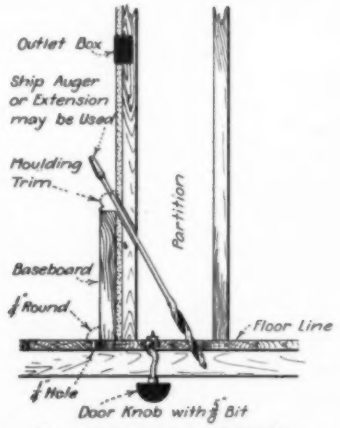


Coil Lifter.

W. R. Smith.

Wiring Old Houses.

The accompanying illustration shows two methods to be used in running wire for a side outlet in a finished house. Most houses have a strip of quarter-round at the bottom of the baseboard, which can be removed by punching the nails through. Then a quarter-inch or five-eighth-inch hole can be bored through the floor, a piece of floor taken up and a hole bored behind the wall by using a bit in a door knob. This is indicated in the figure.



Two Methods for Wiring in Finished House.

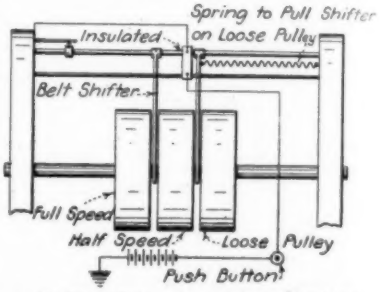
Another method is to remove the molding trim and drill through part of the baseboard and part of the plaster at such an angle as to strike the floor and bore clear through it, as is also shown in the illustration. In this way I have often fished from the center ceiling-outlet pocket without removing a board near the outlet. Both of these methods make a clean job and no traces of the work done are left.

Charles Becker.

Electric Stop for Warping Machine.

I recently had the problem of installing a stop-motion system on a new warping machine. After failing with other methods, the following was found to work satisfactorily.

An electric door lock was used and mounted on the belt shifter of the machine, which was made of insulating material. The catch prevented the belt shifter from moving, normally. There was also on the rod supporting the belt shifter a set screw which made contact with an insulated connection on one side of the lock. When current was applied to the lock, the catch released and a spring would pull the belt shifter over so that the belt was shifted to the loose pulley and the machine was stopped. The machine was wired so that if a thread broke the machine would stop. There was also a chain with a large link over a gear for measuring purposes. This was arranged to make contact and stop when a definite number of yards had been run off. The machine may also be stopped by using the push button shown in the diagram. The other stop contacts are wired to be in multiple with the push button. The frame of the machine is used as a ground to complete the circuit. The lock and catch are insulated from the machine.



Electric Stop for Warping Machine.

When half speed is required the lock and set screw are shifted to correspond to the half-speed pulley. An annunciator was also installed to indicate in which row the thread was broken.

William T. Estlick.

Public Service Commissions

Conducted by William J. Norton

ARIZONA.

The **Pacific Gas and Electric Company.** W. J. Freeman, of Madison, Wis., engineer with the Wisconsin Railroad Commission, has been chosen as the Arizona Corporation Commission's member of the board of appraisal in the case of the Pacific Gas and Electric Company. Recently the Commission and the gas and electric company agreed on rates for gas and electric service but there were a number of items left to be determined by a board of appraisal. The gas and electric company selected R. S. Masson as its member of the board and the two will select a third member.

CALIFORNIA.

Jurisdiction of the Commission. The Railroad Commission has petitioned the State Supreme Court to reverse its opinion in the Oro Electric Corporation case which denied the Commission the right to protect from competition a public service company subject to its regulation. Because of the importance of the issue affecting the jurisdiction of the Commission, the case will undoubtedly be taken to the United States Supreme Court if the state court refuses to change its position.

Rates Reduced. The Commission found that the rates of the Bakersfield Gas and Electric Company were unreasonable and established a lower schedule.

GEORGIA.

The **Supreme Court** has handed down a decision sustaining the contention of the Macon Railway and Light Company that contracts entered into during the competition with the Georgia Public Service Company are now void and that the advanced rates prescribed by the Commission, February 24, 1914, are now effective.

IDAHO.

The Washington Water Power Company was granted a certificate of public convenience and necessity authorizing the construction and maintenance of transmission lines along all the roads of Latah County, Idaho, for the purpose of transmitting electricity for electric light, heat and power purposes with the right to furnish persons situated along such roads with electricity.

ILLINOIS.

Municipal Utilities. It is alleged in the case before the circuit court of Sangamon County, that the city of Springfield in extending its electric lighting plant without securing permission from the Commission is violating the Public Utilities Act. This contention is made on the ground that the exception of municipal corporations from the control of the Public Utilities Commission is invalid, being in violation of the constitutions of the state and United States, and the municipal corporations must obtain a certificate of public convenience and necessity before beginning operation, the same as a private corporation.

The Spring Valley Utilities Company was authorized to construct and maintain an electric light plant and distribution system in the village of Mineral. A branch high-tension line is to be constructed from its main transmission line at a point west of the village of Buda, to Mineral, and the company has the right to furnish customers along this line and within the village of Mineral.

Ordinance of the City of Aurora. Upon petition of the city of Aurora, the Commission issued an order requiring the Chicago Burlington & Quincy Railroad Company, Western United Gas & Electric Company, Chicago Telephone Company, Interstate Independent Telephone & Telegraph Company, Aurora, Elgin & Chicago Railroad Company, Elgin, Joliet & Eastern Railway Company to make the necessary changes in their respective properties and equipment to comply with a city ordinance in the matter of elevation and separation of the tracks of the first named company.

MASSACHUSETTS.

Proposed Legislation. A bill is under consideration which would grant the Board of Gas and Electric Light Commissioners the right to determine what price should be paid for existing lighting plants upon purchase by municipalities. The only appeal allowed from the findings of the Board will be on questions of law.

NEW YORK.

The Syracuse Lighting Company was authorized by the Public Service Commission, Second District, to construct a transmission line in the village of Minoa, Onondaga county, for the purpose of furnishing and supplying electric light, heat and power in the village.

The Rockland Light & Power Company was authorized to issue $463,000 of its capital stock, to be sold at not less than par, the proceeds to be used for the following purposes: to acquire the entire capital stock of the Rockland Electric Company of New York; to acquire and discharge the notes of the Rockland Company of New York of the principal sum of $202,000; to acquire $12,000 par value of the capital stock of the Rockland Electric Company of New Jersey; to pay and discharge its notes or evidence of indebtedness of the principal sum of $15,000 incurred for capital purposes outstanding December 31, 1912; and to pay and discharge current obligations of the Rockland Light & Power Company incurred for capital purposes due and owing December 31, 1912.

The Peoples Electric Light & Power Company. The Commission dismissed the complaint against the Peoples Company of Silver Creek as to conditions of its overhead systems, it appearing that the company is without funds to make any improvements because of the limited income from its business, but that the company would continue to maintain its plant and equipment in a safe and usable condition.

New York Telephone Company. The complaint of residents of the village of Weedsport against the company in the matter of proposed increase in telephone rates was dismissed without prejudice to the renewal of the complaint upon good cause shown at any time the complainants may desire to reopen it.

The Commission dismissed the complaint against the New York Telephone Company, asking for extension of telephone line to serve complainants in Wheatland, Munroe county, and Caledonia, Livingston county, it appearing that the company is willing to make the extension necessary to furnishing such service.

Complaints Dismissed. Complaints of residents of Garden City, Long Island, against the Nassau & Suffolk Lighting Company and the Nassau Light & Power Company as to rates charged for gas and electricity were dis-

missed. The allegations contained in the complaints were not sufficiently specific and the complainants failed to submit an amended complaint as requested by the Commission.

The New York Gas Company applied for authority to transfer its franchises, works and system together with a contract with the Iroquois Natural Gas Company to George Clinton, Jr., for $8,500. The application was dismissed, it appearing to the Commission that such transfer would be contrary to the provisions of the law applicable thereto.

The Rochester Railway & Light Company was authorized to issue $642,548.80 par value of 5-per-cent 50-year consolidation mortgage gold bonds to be sold for not less than 97 per cent of par value and accrued interest, the proceeds to be used for the discharge and payment of underlying real estate mortgages.

OHIO.

The Eastern Ohio Telephone Company was ordered to make certain changes in rates and practice.

PENNSYLVANIA.

Municipal Corporations. The Commission has issued a ruling that a municipal corporation wishing to engage in public service work stands on the same plane as a private corporation, and must secure consent of the Commission before engaging in business.

WISCONSIN.

The Chippewa Valley Railway, Light & Power Company was authorized to issue $6,000 of preferred stock for the purpose of purchasing the property of the Inter-County Light & Power Company of Elmwood.

Duplication of Service. Objection was filed by the Theresa Union Telephone Company to certain of the proposed extensions of the Mayville Rural Telephone Company in the towns of Theresa and Herman. The complaint alleged duplication of lines. The Commission found that public convenience and necessity did not require the extensions where the lines of the two companies would parallel, but the Mayville Company was allowed to proceed with the other extensions planned in territory where there would be no duplication of service.

Changes in Telephone Rates. The application of the Ripon United Telephone Company to increase rates was granted in part only. The company wished to increase its charges in order to meet the additional expense which would be occasioned by changing its system from magneto to common-battery system. Certain changes were made regarding rural service rates and the charges to city subscribers were slightly increased.

The application of the Ettrick Telephone Company to increase rates was favorably passed upon by the Commission. In its petition the company sought to have different charges for subscribers and non-subscribers. The Commission points out that this is an unjust discrimination and the charges ordered in effect were modified so as to eliminate this discrimination.

Permission was given the Badger State Telephone and Telegraph Company operating at Niellsville, Granton and vicinity, to increase its telephone charges as shown in its petition except as to rural subscribers. The increase to the latter class of subscribers was not allowed in full. The rules of the company were also reviewed and certain modifications made.

Curtiss and Withee Telephone Company vs. The Owen Telephone Company. The Commission rendered a final decision in this case. An order had been previously entered compelling the respondent company to reconnect the petitioning company to its line until such time as the Commission could pass upon the merits of the dispute ever the charges to be made for such connection. The Commission now finds that the petitioner had agreed some years ago to transfer its property in the village of Owen to the respondent on condition that the respondent would give connection to the petitioner's subscribers at a flat rate per annum and an optional message rate. The Commission held that the rates then agreed upon were reasonable except the message rate, which was modified so as to bring about a decrease in the charge for service.

Telephone Security Issues Authorized. The Plankroad Telephone Company was authorized to issue $200 of stock.

The Marion and Northern Telephone Company was granted authority to issue $350 of preferred stock and $1,000 of common stock. The purpose of the issue is to secure funds for rural extensions and the purchase of telephone instruments.

The Ogema Telephone Company's application for authority to issue $3,500 of stock, the proceeds of which was to be used toward the payment of indebtedness incurred by the company in extending its telephone lines, was granted by the Commission.

Germany now uses between forty and fifty million gallons of denatured alcohol a year, of which over thirty million gallons are sold to the general public for burning purposes. France uses about eighteen million gallons per year, the United States about ten million gallons, and the United Kingdom four million.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 218.—Panama Canal Locomotives.—What reasons were considered for adopting the very low potential of 220 volts for the towing locomotives for the Panama Canal? Why was three-phase current chosen instead of direct current, which has many advantages as long as high voltage was not to be employed? Why are two very heavy and costly copper "third" rails used as contact lines? Why is the rack-rail construction such a one as to take hold of the rack pinion?—A. G., Wilkinsburg, Pa.

No. 219.—Reversing Electric Toy Train—Some electric toy locomotives are made to reverse by means of a reversing switch on the locomotive, but this requires stopping the train and changing this switch. Is it possible to arrange the outfit so that reversing can be done from the control station without touching the locomotive I have been told it would require four rails for each track. Can this be done with only the three rails usually provided?—D. H. S., Rockford, Ill.

No. 220.—Patentability of Combination Invention.—If a person invents an entirely new device by bringing about, after prolonged experimentation, a very difficult but successful combination of parts already in use, can a patent be secured on the new device? For example, I have been told that the new nitrogen-filled tungsten lamp cannot be patented because nitrogen and other inert gases had already been used during the early development of incandescent lamps and concentrated tungsten filaments have been employed in standard tungsten lamps for a year or more. Is this matter covered by the patent laws or has the practice been determined by the courts?—J. W. T., Toledo, O.

No. 221.—Quartz Lamps on Alternating-Current Circuits—Why can the ordinary quartz-tube lamp not be used on alternating-current circuits? Are any such lamps available for these circuits?—B. W., Denver, Colo.

Answers.

No. 213.—Electric Motorcycle.—Is there on the market at the present time an electrically propelled motorcycle or quick-delivery car? If so, please describe

same briefly and give manufacturer's address.—A. J. L., Hazelton, Pa.

To the writer's knowledge, there is no electric motorcycle on the market today. There has been, however, an electric motorcycle developed by an actor who is at present living at the White Rats Club, New York City. The machine consists of a stage bicycle from which the pedals have been removed and a countershaft substituted, to which has been attached a Gray & Davis six-volt automobile-engine-starting motor, and two sets of three cells each of Vesta storage battery. The motor is capable of developing as high as 1.25 horsepower, and a simple double-pole knife switch serves to start and stop the motor, and is operated by foot. The inventor claims that the wheel can travel at 25 miles an hour for more than six hours. Due to the flexibility of the electric motor and the more nearly perfect torque as compared with the gasoline motor, as well as the lightness of the amount (with batteries it tips the scales at but 150 pounds), hills prove no obstacle, despite the low power of the motor.—E. J. R., New York, N. Y.

The only electric motorcycle that I ever heard of was through the Grand Rapids press a few years ago. If I remember rightly, it was made in Detroit, Mich., by a man named Woods. It carried a 30-volt storage battery set lengthwise of the machine. The motor was under the seat and was belted to the rear wheels. The machine weighed less than 200 pounds and was capable of making 20 miles an hour. Various speeds were obtained through a battery selector controlled by the grips on the handlebars.—C. S. K., Grand Rapids, Mich.

[In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 12, 1911, a description was published of an electric motorcycle invented by F. E. Hatch and manufactured by the Electra Cycle Company, 313 North Ashland Avenue, Chicago, Ill. No trace of this firm nor of the inventor has recently been found, however.—Ed.]

No. 215.—SUCTION STREET SWEEPER.—Has the use of electrically operated suction street sweepers ever been tried out by any street-railway company to keep its tracks free from dust and dirt? The kind I have in mind would be operated from the trolley line just like a snow sweeper, but instead of throwing the dirt over the rest of the street would suck it up into a dust compartment.—V. B., Milwaukee, Wis.

In this part of the country the city takes care of the cleaning of the whole street, which does away with the necessity of the street-car companies doing any thing of that sort. There is no question, however, but what such a cleaner would be a success, as gasoline-driven cleaners are already in use and are proving very satisfactory.—J. H. M., San Francisco, Cal.

Although no street cleaners of the type referred to have been used to my knowledge, this is chiefly due to the fact that street-railway companies are prone to shirk any special cleaning of the tracks and will throw this burden onto the city, despite the saving that would be effected in the cleaning of the cars and the greater comfort to passengers from riding in cars free from dust pollution. The plan proposed by V. B. is entirely practical and could be carried out very successfully at relatively low cost. Storage-battery-driven street-cleaning and sprinkling machines have been used in several European cities with success, therefore similar machines operated by trolley current should be even more successful. If the track roadbed is kept quite free from ruts and bumps, a suction machine should be the ideal type of cleaner for this purpose. The additional power required to operate the suction machinery is not very great with a well paved track and is already available from the trolley line. Where the company is not obligated to keep its tracks swept, it might take over from the city this part of the street cleaning and derive some revenue thereby.—L. C. M., Chicago, Ill.

No. 217.—TELEPHONE GENERATORS.—Why will a 2,000-ohm telephone generator when turned 120 revolutions per minute make a 10-volt, 15-watt Mazda lamp burn up to about two-thirds candlepower while it will not make a six-volt Mazda lamp of any candlepower that I have turn even red? It will also make the low of a 110-volt Hylo lamp burn up to and over candlepower.—C. M., East Las Vegas, N. M.

Some telephone hand generators give a difference of potential of over 100 volts, on open circuit, when turned at normal speed. But owing to the high impedance of the armature, such generators cannot generate a current of more than a fraction of one ampere, even when short-circuited. A 110-volt Hylo lamp of the Mazda type requires only about 0.05 ampere, on low. The telephone generator will generate this volume of current at a sufficiently high voltage to light the lamp. A six-volt lamp requires a large volume of current in proportion to the watts consumed. For example, a 12-watt, six-volt lamp must have two amperes to make it burn at full candlepower. I doubt if there is a telephone hand generator made that will give more than one-third ampere. A 10-volt, 15-watt lamp requires 1.5 amperes at full efficiency and more than one ampere at two-thirds candlepower, so I think the party asking the question must be mistaken in regard to the rating of the lamps referred to.—W. F. H., Gordon, Neb.

It is assumed that the generator in question is of the magneto type, having permanent magnets for fields, and delivering alternating current at the terminals. The fact that such a generator will light the "low" of a 110-volt Hylo lamp and will operate a 10-volt, 15-watt Mazda lamp at about two-thirds candlepower, but will not light a six-volt Mazda lamp is due to the characteristic of the machine and the fact that the current necessary to light six-volt Mazdas of any candlepower is beyond the capacity of the generator. Generators of this type have a drooping characteristic, that is when run at constant speed the terminal voltage decreases along a curve as the load is increased. The shape of the curve will depend upon the design of the machine, but in all generators of this type it falls off very rapidly as the full-load output is exceeded, on account of armature reaction and the high impedance of the armature circuit. The normal current of a 10-volt, 15-watt Mazda is 1.5 amperes and its resistance when hot is between 6 and 7 ohms. As the lamp was operated at about two-thirds candlepower, the current was probably not in excess of 0.5 ampere and its resistance was probably in the neighborhood of 7 ohms. On these assumptions the voltage at the lamp terminals would be approximately 3.5 volts. The resistance of the six-volt Mazda would be less than 7 ohms and the voltage which the machine could maintain at the lamp terminals would be proportionately less than 3.5 volts and not enough to operate the lamps. The "low" of the Hylo lamp was operated at full candlepower because of the small current required and the high resistance of the lamp circuit.—H. S. P., New York City.

[Similar answers from C. E. R., Menominee, Mich., and H. E. W., Chicago.]

Choice of Electric Motors.

In a paper by E. F. Butler on "The Operation and Maintenance of Electric Motors," recently read before the Junior Institution of Engineers, the author pointed out that as regards maintenance the object was to run the plant with as few interruptions as possible and without excessive cost. A frequent cause of trouble was that installations were put in without taking account of the working conditions and the class of people by whom the machinery was to be handled. To get the best results the upkeep of the plant should be considered before it was installed, and the points to which special attention should be paid were suitability to the requirements, accessibility, the use of the smallest possible number of different sizes of motors, and standardization in every possible way, so that the number of spare parts and replacements which had to be kept in stock might be reduced to the utmost. In regard to the choice of motors and their control gear, the author enumerated the constructional features which should be found in a good machine and gave a series of practical hints for remedying faults.

THE EFFICIENCY OF ELECTRICITY TO THE HOUSEKEEPER.

By Helen L. Bartlett.

Miss Bartlett is teacher of cooking at the Salt Lake High School, Salt Lake City. The article herewith formed the basis of a paper read before the Home Economics Section of the Ladies' Literary Club of Salt Lake City, and it was read later to the members of the Utah Electric Club. It was so favorably received and attracted so much attention from many quarters that it is believed that a great many of our readers will find some of its statements and suggestions particularly helpful in their new-business work.

The problems of the household are more difficult today than they have ever been, for each advance in science, each modern invention, has brought in its wake new responsibilities and new duties. With the increase of modern conveniences has come increased care.

Standards of living have changed as well, and greater perfection in all household service is demanded of the home-maker.

Much progress has been made, but even today the housekeeper is often a little slow in availing herself of the latest modern appliances. This is partly because of the common feeling that what our fathers and mothers knew is good enough for us, and partly because so much of the information is still locked up in more or less technical books. On the other hand there are those, like ourselves, seeking to apply every efficiency method to the home.

As a teacher of home economics, I am greatly interested in electric cooking. While the food question is by no means the one thing in housekeeping, as it is apparently so often considered, it yet is of real and vital importance.

The housekeeper who desires to make the most of her opportunities, to contribute her ability to the welfare of her family, should keep an open mind toward new knowledge. Now it is time for a new and better way—The Electric Way.

Electric cooking is as superior to fire cooking as the electric light is to the tallow candle.

First I wish to explain the installation; secondly, how to operate cooking utensils; and the most important of all, the advantages of electric cooking.

The expense of installing special wiring in houses already completed is far less than is generally supposed. The clever way electricians have of fishing wires between walls, makes the job much simpler than one would believe possible, and rarely occasions much noise or litter about the house.

Only appliances consuming more than 600 watts require special wiring, and can not be connected to a lamp socket, for example: the electric range or oven; all the others may be attached to the ordinary lamp socket.

When an electric cooking appliance of reliable make fails to produce satisfactory results, a voltmeter, applied while the maximum current is being used, will almost always show that full voltage is not being delivered.

The final connection to the appliance is usually made with a flexible cord or cable, with a plug on the end which is simply pushed into an outlet in the baseboard or wall provided for it.

Thus the portable feature of the appliances can be fully utilized, and they may be used in any room of the house.

One must know how to operate electric cooking appliances because electric cooking is different from fire cooking.

In fire cooking we have become accustomed to wasting over nine-tenths of the heat. In electric cooking one must learn to utilize the heat with as little waste as possible.

Be sure to shut off the current, when it has done its work; furthermore, the heat stored in the stove will keep the food boiling for some time after the current is shut off. Much current is saved by switching it off some time before the food is done, thus making the stove an excellent fireless cooker.

Do not expect food to heat up as rapidly as on a hot wood, coal or gas stove, in all of which, from 10 to 30 times the heat needed is wasted and naturally there is heat to spare—and food is often scorched. Use the high heat only long enough to bring the food to the boiling point, then keep it boiling on the medium or low heat.

For electric cooking use only utensils made of copper, aluminum, tin, steel or nickel ware. These materials are good conductors of heat and lose little by radiation. Do not use granite ware—granite is a heat insulator.

Never use utensils with a bulging bottom; it must be flat or slightly concave. Those that are made to fit and lock on, utilize all the heat, for there is a perfect contact of utensils with the stove; also there is no danger of the utensil being knocked off the stove. Keep the dish covered; that confines the heat and is better for the food.

Then there is the electric oven. Ovens in other stoves are ventilated to let the fumes and odors of the fire escape and they have heavy walls in which the heat is stored. The electric oven, on the other hand, is tight; the work of baking is done by clean hot air which must not be allowed to escape. Therefore, keep the oven door closed and watch the baking and roasting through the glass door.

Cooking by electricity is very simple because there is nothing complicated or fussy about it. There are no matches to strike. When you want heat you have it for the simple push of a button or turn of a switch; and when through, a turn of the switch stops it that second.

There are no fire combustions, therefore no smoke to dirty the operator or the walls and ceilings, no ashes, no burnt matches, no fumes.

The cooking utensils keep cleaner outside and are easy to clean inside because the food rarely scorches or sticks to the dish. Food seldom boils over, and if it does, there are no little holes or slits to clean, for electric stoves are simple in construction.

Electrically cooked food is healthful, for electric heat is perfectly clean. Electricity does not poison the air. An ordinary candle uses up almost as much air as a person. Compare a candle with the burners of a gas stove and think what they do to the air. Electricity does not leak, and if it could it would do no harm. Gas leaks out through the valves and from the joints around the stove.

Gas ovens must be ventilated to allow the fumes of the fire to escape. Not so with the electric oven, which needs no ventilation. Therefore, the oven is built tight and as a result the nutritive value of the food is conserved. Bread has a more tender crust, meats shrink less because the valuable juices are not dissipated, and all foods cooked in the electric oven are more palatable and digestible.

In cooking by electricity you do not speak of "working over a hot stove." The heat is confined to where it does its work; it is not wasted to heat up the room or the operator.

Electric cooking is safe because there are no matches. Matches cause over $3,000,000 fire damage every year. Matches are poisonous and a thousand children die each year from eating their tips.

There is no flame to burn you; it does not flare up nor does it go out when turned down low. Gas often does, and you know what happens then. Gas mixed up with air and ignited explodes and has caused many serious accidents.

Cooking by electricity is economical because the heat is applied where needed and nowhere else; very little of it goes to waste. Current is used only while actually needed and expense stops the instant it has finished its work. Most operations are com-

pleted with the stored-up heat, the current being turned off some time before finishing, as in the fireless cooker.

It saves the food, which is rarely lost by boiling over; it seldom scorches or sticks to the utensils. It saves the expense of redecorating, on account of cleanliness. The cost of refinishing a single room will pay for a large amount of current, to say nothing of the annoyance of painters and calciminers around. Electric cooking saves labor and time in the cooking itself, as well as in keeping the kitchen and clothing clean. It often saves the expense of a servant, for it means freedom from the hardship of working in a hot room.

It means that you can dress for dinner, cook it, serve it hot, and be in condition to sit down and enjoy it yourself.

Cooking by electricity is a pleasure because all of the drudgery is gone; it means better cooking with greater certainty as to results.

Therefore, the advantages of electricity for cooking are many, as it is simple, clean, healthful, safe economical and pleasant. It means working in a modern sanitary way—the science of housekeeping realized.

The British Wireless Chain—Particulars of Stations.

In the course of a paper on wireless telegraphy read before the North East Coast Institution of Engineers and Shipbuilders, England, in which the subject was covered generally and a comparison of different systems made, H. Fothergill on April 23 gave the following details of the stations which will form the British imperial wireless chain.

Six high-power stations are to be erected. One station in England for signaling in the direction of Egypt; a station in Egypt for communication in three directions—India, East Africa and England; a station in the East African Protectorate for communication in two directions—Egypt and South Africa; a station in the Union of South Africa for communication in the direction of East Africa; a station in India for communication in two directions—East Africa and Singapore; and a station in Singapore for communication in two directions, namely, India and Australia, where the erection of another high-power station is receiving consideration. These stations will be operated on the high-speed automatic system, and will be worked duplex.

The wave-lengths of all stations will be as great as possible within the limits of 15,000 and 50,000 feet (consistent with keeping the capacity, inductance and size of the aerials within reasonable limits) in order to ensure reliability of reception at all times of the day and night; but the wave-lengths transmitted from any one station will be in all cases at least 25 per cent different from those transmitted from other stations within its normal range, and with which it has to communicate. In all cases there will be a difference of five per cent between the wave-lengths emitted from any one station in order that each corresponding receiving station with which this station has to communicate may be able to tune out the waves emitted by the said station for the other station or stations with which it is also communicating. Where a station is required to communicate in more than one direction, a separate transmitting aerial and a separate receiving aerial will be provided for each direction The note of each station will be different from those of any other stations within its range, but the notes of each transmitting circuit in any one station will be identical.

The power plant at each station will be in duplicate, and will include two water-tube boilers, each capable of generating sufficient steam for the whole requirements of any one transmitting circuit. In the case of station required to send in two directions three boilers will be provided; and in the case of the station in Egypt, which is required to transmit in three directions at the same time, four boilers will be provided. The boilers will supply steam to turbines directly coupled to alternating-current generators which in turn will be coupled to revolving-disk dischargers. The total power, including spares and auxiliaries at the terminal stations will be approximately 1,300 horsepower, and the power at the intermediate stations will vary from 1,900 horsepower to 25,000 horsepower. Two auxiliary sets will be provided at every station, each consisting of a turbine coupled to a direct-current generator for supplying exciting current to the alternators and current for lighting and other auxiliary purposes.

The transmitting aerials will be of the multi-wire directional type and will consist of a number of horizontal parallel wires supported 300 feet high by 10 masts, each wire being composed of seven strands of No. 19 S. W. G. silicion-bronze wire and brought down at one end to the transmitting station. The masts will be of the sectional-steel tubular type, the aerial wires passing through insulators attached to triatics stretched between pairs of masts, each mast being capable of withstanding a permanent horizontal strain of not less than two tons at the head of the mast, in addition to windage calculated at the rate of 30 pounds per effective square foot. The center line through the horizontal portion of the aerial will coincide with the line of direction of the station with which it is desired to communicate, the free or elevated end of the aerial pointing directly away from the communicating station. The size of the aerials in each case will depend upon the length of wave emitted, but in no case will the length of each aerial be less than one-twelfth of the wave-length that the aerial is required to radiate.

The ground system will consist of a series of galvanized-iron plates buried in a symmetrical position relatively to the station house and connected to it by a system of radial conductors of galvanized-iron wire leading to each plate from another set of plates buried around the station building.

Each transmitting circuit at each station will be provided with five transformers and a condenser consisting of about 500 cells. The high-frequency transformer for each circuit will comprise a multi-stranded primary conductor forming part of the oscillatory circuit, and a secondary winding connected to the radiating circuit and consisting of a special solenoid of similar cable to the primary winding but of smaller size. These primary and secondary windings will be entirely separate and arranged to be moved away from each other so that the coupling of the two circuits may be varied. The disk discharger in the oscillatory circuit will consist of a studded wheel, the number of studs corresponding to the number of the alternator poles, so that the condenser can be discharged at the moment of maximum amplitude in each alternation of the current. The two side electrodes, between which the moving studs pass, are of special construction and consist of slowly revolving disks so as continually to present a cool surface for the discharge.

The receiving and operating stations will be less than 10 miles distant from the transmitting stations, and will be provided with balancing aerials so as to prevent interference by the waves radiated from an adjoining transmitting station. The receiving aerials will consist of one or more silicon-bronze, stranded conductors about 8,000 feet long and arranged similarly to the wires of the transmitting aerials. The operating room will be fitted with Morse hand keys and Wheatstone or other automatic transmitters of similar type. These will be connected by means of wires to the transmitting station which will be operated from the receiving station.

Electrical Convention in England.

English municipal electric supply engineers and committeemen forming the Incorporated Municipal Electrical Association, will hold their annual convention from June 15 to 20 at Birmingham, England. R. A. Chattock, city electrical engineer of that place, is president. W. A. Vignoles is to open discussion of the subject of "Commercial Development of Electrical Supply in Towns of Moderate Size"; J. H. Bowden will introduce "Standardization of Tariffs;" and S. E. Fedden will read a paper on "Design and Operation of Modern Boiler Plants."

ELECTRICITY AND MATTER.[1]

By Henry S. Carhart.

I am well aware that my subject is a difficult one; it does not lend itself readily to popular exposition and illustration. But it has intrinsic attractions, for men of philosophic mind have ever inquired into the nature and constitution of matter; not of forms and organisms alone, but of the ultimate nature of the material out of which the whole physical universe is made. I say the whole physical universe advisedly, for during the past century the spectroscope has revealed to us the existence in sun and stars of the same elementary substances that are present in the earth. Indeed, the discovery of helium in the sun preceded its discovery in the earth by 30 years, thus reversing in a most remarkable manner the order of identification of terrestrial and solar elements.

Interest in the inquiry relative to the nature of matter has been enormously stimulated by the revolutionary discoveries of recent years, made through the agency of electricity. In fact, more progress in this field has been made in the last 35 years than in any preceding century. The point of attack has been matter in the gaseous state, and the instrumentality, the discharge of electricity in high vacua. I hope to give in a brief way some of the successive steps by which these discoveries have been made.

It is now 35 years since Sir William Crookes made his epochal discovery of matter in what he aptly and prophetically termed the fourth, or ultra-gaseous, or radiant state.

The discovery of X-rays by means of Crookes tubes was announced by Roentgen in 1895. They are produced in some mysterious manner when cathode rays are suddenly stopped, especially by heavy substances like platinum. Their most striking properties are their ability to penetrate thin metallic sheets and other opaque substances, their effect on a sensitized photographic plate, and their power of exciting fluorescence in certain salts, especially plation-cyanides. It is by means of this fluorescence that we are enabled apparently to look through opaque bodies.

The activities of X-rays in promoting photographic changes led directly to the discovery of the radioactivity of uranium by Becquerel in 1896. Becquerel found that uranium salts give off spontaneously radiations capable of passing through black paper and thin sheets of aluminum foil, and affecting photographic plates, as X-rays do. These radiations are not modified in any way by the most drastic physical treatment of the uranium, whether of heat or cold or other physical changes. You know that Madame Curie in the search for other radioactive substances discovered the most remarkable element known to science; I mean radium. One of the striking properties of radium is its ability to promote the discharge of electrified bodies. This means that the radiations from radium are able to ionize the air, that is to resolve it into parts which are carriers respectively of positive and negative charges of electricity; for gases do not conduct electricity unless they are first ionized. The charged ions then move with their charges, thus conveying a current.

It is necessary at this point to make a slight digression for the purpose of describing the composite nature of the radiations from radium and similar bodies. There are three sorts of radiations from radium, which are known as alpha, beta and gamma rays or radiations. None of these are rays in the sense in which the word ray is used in light, with the possible exception of the gamma rays. The beta rays have been identified with cathode rays in a Crookes tube. They consist of minute particles carrying or composed of the same quantity of negative electricity, and they are called electrons. They are the same whatever their source, and they travel with a speed of the same order as the velocity of light.

Alpha rays are positively charged radiations, traveling with a much smaller velocity than that of the beta rays. They have now been definitely identified with the atom of helium. Alpha rays have only relatively slight penetrating power and are quickly absorbed.

Gamma rays are uncharged or electrically neutral radiations, and quite analogous to X-rays. Their penetrating power is immensely greater than that of either alpha or beta rays. Since they are not electrically charged, they are unaffected by either electric or magnetic forces.

Even beta rays may be resolved into many distinct groups which suffer different deflections under the influence of a magnetic field.

Some 30 years ago Aitkin made the discovery that fine dust particles serve as nuclei for the condensation of moisture and the precipitation of rain. Sudden expansion of saturated air causes a precipitation of a fog if dust particles are present; in their absence it was concluded that the expansion and consequent cooling must be carried much further than is necessary for condensation when dust nuclei are present. But when no cloud was formed in dust-free inclosed air by sudden expansion the heating to redness of a platinum wire in the inclosure was immediately followed by condensation. The scientific men of that day, including Sir Oliver Lodge, did not imagine that the hot platinum wire gave off anything but dust and invisible smoke. At that period the electron was not even known, much less its function in ionizing the air and thus furnishing nuclei for the condensation of moisture. It has now been abundantly demonstrated that alpha, beta and gamma rays all produce ionization of gases, and that these ions in turn condense moisture. Thus a way has been opened to make visible the track of electrons and alpha particles. C. T. R. Wilson, of England, has been most ingenious in devising methods of making visible the trajectories of flying particles and even of photographing them. So now we have lantern slides to bring to the eye evidence of the presence and efforts of these smallest known bodies of the physical world, these ultimate corpuscles of matter or electricity, whichever it may be.

The path of an individual alpha particle is shown by the condensation of water on the ions formed in its path, and is seen as a straight luminous trail, which was photographed.

A similar effect is produced by beta particles, but the trail is not so intense and is discontinuous, showing the condensation on individual ions, on account of the higher speed and smaller ionization of the lighter and swifter particles.

The number of ions produced in air at atmospheric pressure depends on the speed of the particles. For alpha particles it varies from 2,000 to 6,000 per millimeter of path, that is, between 50,000 and 150,000 per inch. The high-speed beta particles in general are much less efficient ionizers; they produce not more than 20 or 30 ions per millimeter of path, that is, 500 to 750 per inch. In most cases the number of ions produced is minute compared with the number of molecules present. It is possible to detect the presence of one or two ions in a cubic centimeter per second, while the number of molecules in a cubic centimeter at standard temperature and pressure is 2.7×10^{19}.

Beta rays, you will recall, consist of electrons. The electron is often called the "atom of electricity." It is probably the ultimate element out of which all matter is built, or at least, it enters into the structure of every atom of matter. Until recently the atom of hydrogen was supposed to be the smallest existing mass of matter. The atom, as the word signifies, was the ultimate mass indivisible by any known means. But the electron has a mass only 1/1800 as great as the atom of hydrogen, and

[1] Lecture delivered in extension course of Throop College of Technology.

all electrons are the same, whatever be their source. Thus the old "atom" of chemistry has lost forever its character as the ultimate body into which matter may be resolved. Instead of 60 or 70 elementary atoms, we now have one ultimate electron; even that may be only negative electricity, for its mass is not a constant, but varies with its velocity. If its velocity approaches that of light, its mass is nearly trebled as compared with a velocity one-third that of light. Even the constancy of the mass of matter is therefore brought in question by these latest discoveries on the borderland of matter. The change of mass incident to high velocity is too infinitesimal, except in the case of high-speed electrons, to affect in any appreciable degree the masses known to astronomy and the ordinary masses of physics and daily life.

The old alchemists sought in vain to transform one element into another. The object of their research was the production of gold and not pure science. Their failure has in it a lasting lesson for men of science. Not mere commercialism, but the love of discovery must be the chief stimulus and ruling impulse in scientific work. The marvel now is that in this new century the discovery of the spontaneous transmutation of one element into others in three or four stages has put to shame the fettered imagination and the commercialized search of the alchemists.

The oxide of uranium was discovered in 1789 in the mineral pitchblende, which is now the chief source of radium. It was not until 1840 however that metallic uranium was reduced from one of its ores. Uranium compounds are now manufactured in large quantities. They impart to glass a rich yellow-green color, which fluoresces in the light of a Geissler tube.

Uranium has the highest atomic weight of any known substance, namely, 238.5 times the atomic weight of hydrogen. It is ordinarily obtained from the mineral uranite, where it is always associated with the other radioactive substances, ionium, radium, and actinium. This association was suggestive of the transformation of an element of high atomic weight into others of successively lower atomic weight. Such has been found to be the case. Uranium is the parent of ionium, and ionium is the parent of radium. Uranium is thus the primary source from which radium is derived, and radium is a disintegration product. Further, radium gives off a gas known as radium emanation, which is also radioactive, that is, it emits alpha, beta and gamma particles. The radium atom disintegrates with the expulsion of an alpha particle, and the residue of the radium atom becomes the atom of the gaseous radium emanation. Now if this gas is sealed in a small spectrum tube and examined with a spectroscope, after a few days the characteristic spectrum lines of helium appear. Thus a known element is produced during the transformation of radioactive matter. The alpha particles expelled from radioactive matter, after losing their positive charge, become atoms of helium. It has been conclusively shown that alpha particles from all types of radioactive matter are identical and consist of helium atoms carrying two positive charges, each equal to the charge on a negative electron. Every radioactive substance, which emits alpha particles during its transformation, gives rise to helium in proportion to its rate of emission of alpha particles. As an example of successive atomic transformation we have the established series, uranium, ionium, radium, helium.

The disintegration of uranium results in the expulsion of eight atoms of helium. The atomic weight of helium is very nearly four, and the eight atoms therefore weigh 32. Deducting 32 from the atomic weight of uranium, 238.5, there is left 206.5. This is very nearly the atomic weight of lead, 207. Hence the suggestion that the end product of the disintegration of uranium is lead. The evidence derived from the study of uranium minerals makes it almost certain that lead is the final product of the disintegration of uranium. Much uncertainty remains relative to the end product of other radioactive substances. Atomic explosions result in a loss of alpha, beta and gamma particles, until the excess energy is exhausted and only the end product in each case remains.

The proof that negative electrons exist in all kinds of matter has given a great impulse to the study of the constitution of the atom. The evistence of atoms and molecules has been in no way changed by the discovery of electrons and their properties; but instead of pausing at the atom as the ultimate form of matter, the investigation is now carried further into the constitution of the atom itself.

One of the earliest hypotheses relative to the structure of the chemical elements was that they are built up of hydrogen. The atom has generally been supposed to consist of a number of positively and negatively charged particles held in equilibrium by electrical forces. These particles are no longer conceived to be hydrogen atoms, but the much smaller particles now known as electrons or aggregations of electrons. Thus the present prevailing view is that the atom consists of a sphere of positive electrification surrounded by a number of negative electrons moving around in minute orbits. Sir J. J. Thomson has investigated the several possible stable arrangements, and has found that different groupings differ widely in stability. Some may acquire an extra electron or two and yet remain stable. Others readily lose an electron without disturbance of their stability. The former would correspond to electronegative atoms; the latter to electropositive ones.

Atoms consisting of a number of revolving electrons may radiate energy very slowly, but the continuous drain of energy will finally result in a rearrangement of its constituent parts, or in the expulsion of electrons. This continuous loss of energy, which is known to take place in the case of radioactive bodies, may be the cause of their disintegration.

The great discovery of radiant matter by Crookes has been followed by the complete identification of cathode rays and beta particles from radium and other radioactive substances. They consist of electrons carrying or composed of the negative atom of electricity, and their mass is only 1/1,800 that of the hydrogen atom. They are thus the lightest bodies known to science. They are given off by electric force, by light, by heat, and even spontaneously in radioactive bodies.

Further, since the alpha particles from whatever source consist of helium atoms, and helium is widely distributed in the earth, the sun, and in many stars, as shown by the spectroscope, it would appear that helium is one of the more elementary substances from which the heavier atoms are built. It is significant in this connection that the atomic weights of a number of elements differ nearly by four, the atomic weight of helium. The positively charged center of the atom consists in part at least of charged helium and hydrogen atoms, though it is difficult to see how these parts are held together.

Nor is it at present conceivable in what manner the heavier atoms were originally built up from the lighter ones. The process of disintegration does not appear to be reversible. Enough mystery still remains in the constitution of matter to occupy the mind of man in its solution for generations to come. But it is the glory of this age that a great step in advance has been taken.

The small cinders and fine dust which formerly issued to an annoying extent from the smokestacks of the Waterside stations of the New York Edison Company, New York City, have practically been eliminated by a flue-gas washing process with which the 114 boilers in the two stations have been equipped.

Exhibit of Northern White Cedar Association.

One of the most convincing examples of the tendency of manufacturers to cooperate in improving conditions in their particular field was the exhibit of the Northern White Cedar Association at the Forest Products' Exposition held at the Coliseum, Chicago, April 30 to May 9, inclusive. The object of this particular association is to establish grades of poles, posts, ties and shingles which will be standard, and to maintain these grades so that the purchaser may be sure of procuring material suitable for his purpose. The exhibition maintained in Chicago was for the purpose of demonstrating to engineers, architects, dealers and consumers the many advantages of Northern white cedar.

The space occupied by the Association was decorated in a very pleasing and appropriate manner. At the rear of the space was a stockade built with cedar poles of seven, eight and ten-foot lengths, with five-inch tops, and three sides of the space were inclosed by a cedar fence built of six-inch halves of seven and eight-foot lengths surmounted by a railing constructed of seven-inch quarters, the latter being the smallest sizes of posts manufactured.

A feature of the exhibition which attracted considerable attention was a pole line constructed by workmen of the Chicago Telephone Company, employing four six-inch by 25-foot poles in each corner of the exhibit space and one seven-inch 35-foot pole in the center. Particular attention was directed to the taper of these poles, which are so much more advantageous than straight ones.

In the center of the booth were two exhibits which also attracted considerable attention. One of these showed two standard railroad ties which were in use by the Chicago and North Western Railway continuously for 29 years. Cuts in the wood indicated no material deterioration just beneath the surface. The other exhibit was of a pole cut into sections which was installed in 1864 by the Western Union Telegraph Company in connection with a telegraph line between Green Bay, Wis., and Escanaba, Mich. After 50 years of continuous service this pole was removed and cuts made to determine the condition of the wood. Although one of these cuts was made at the ground line, the wood was found to be in excellent condition about one inch from the surface.

General products exhibited included samples of shingles, butts of various size poles and numerous samples of tops of poles showing how they are measured and classified by the producers. A quantity of cedar tow was also exhibited, this being shavings from cedar shingles, which is used in the manufacture of cheap mattresses and also to some extent by florists and nurseries.

A large number of photographs showing the evolution of the cedar pole from the forest to the completed product were shown, and also views showing the damaging effect on substitutes for cedar poles by severe storms. Several photographs taken during a snowstorm showing damage done to reinforced concrete poles were also on display. The members of the Northern White Cedar Association, 28 in number, each spent a portion of the time at the exhibit. The Exhibit Committee having charge of the display included E. L. Clark, chairman; I. S. Kirkpatrick, H. S. Gilhey, L. A. Page, Jr., and W. B. Thomas.

N. E. Boucher, of Minneapolis, is secretary of the Association, which includes the following member companies:

Bay de Noquet Company, Nahma, Mich., Bell Lumber Company, Minneapolis, Minn., Clark Pole & Tie Company, Bemidji, Minn., Cloquet Tie & Post Company, Cloquet, Minn., Crawford Cedar Company, Menominee, Mich., Curry & Whyte Company, Duluth, Minn., Duluth Log Company, Duluth, Minn., Erickson & Bissell, Escanaba, Mich., Finch Brothers, Duluth, Minn., Learned Cedar Company, Minneapolis, Minn., McCullough & Moss Lumber Company, Minneapolis, Minn., MacGillis & Gibbs Company, Milwaukee, Wis., Martin Brothers, Duluth, Minn., Maloney Brothers, Spooner, Minn., National Pole Company, Escanaba, Mich., Naugle Pole & Tie Company, Chicago, Ill., Page & Hill Company, Minneapolis, Minn., T. M. Partridge Lumber Company, Minneapolis, Minn., Pendleton & Gilkey, Minneapolis, Minn., St. Croix Pine & Cedar Company, Blackduck, Minn., I. Stephenson Company, Trustees, Wells, Mich., W. C. Sterling & Son Company, Monroe, Mich., Torrey Cedar Company, Clintonville, Wis., Valentine-Clark Company, Minneapolis, Minn., Western Electric Company, New York City, N. Y., White Marble Lime Company, Manistique, Mich., Wisconsin Land & Lumber Company, Hermansville, Mich., C. H. Worcester Company, Trustees, Chicago, Ill.

Photo by Lee J. Saylor, Chicago

Exhibit of Northern White Cedar Association at Forest Products' Exposition.

COPPER PRODUCTION AND PRICE IN 1913.

By John B. C. Kershaw.

The annual statistical circular relating to the world's supplies of copper in 1913, prepared by Messrs. H. R. Merton and Company, of London, has just been published, and a summary of the leading figures is given below.

Total World Supplies of Copper in 1913.

The aggregate output by the leading countries of the world in 1913 in English tons (2,240 pounds) of line copper, amounted to 986,375 tons—a decrease of a little under 20,000 tons, when compared with the record output of 1,006,110 tons in 1912.

TABLE I. TOTAL WORLD'S OUTPUT OF COPPER, 1900-1913.

Year	Output in Tons of 2,240 Pounds	Increase or Decrease
1900	479,514	7,270
1901	516,628	37,114
1902	541,295	24,667
1903	574,775	33,480
1904	644,000	69,225
1905	682,125	38,125
1906	714,100	31,975
1907	713,965	—135
1908	754,180	40,215
1909	839,425	85,245
1910	864,271	24,850
1911	871,920	7,645
1912	1,006,110	134,190
1913	986,375	—19,735

Table I contains the figures for the world's total output of copper from the year 1900 onwards, with the relative annual increase or decrease in the production. Only once previously during this period (in 1907) has a decrease in the production been recorded. Following upon the enormous increase of the year 1912, the decrease of 1913 was not unexpected or unforeseen. It indicates that supplies have once again overtaken the demand, and that producers are slackening off the activity of mining and smelting operations, in the hope of preventing any sudden collapse in price, such as that which occurred in 1900, and again in 1907. So far, this policy of restricting the output appears to have been moderately successful, and on December 31 the price of G.M.B. copper in London was $316.60 per ton, as compared with an average of $331.80 for the whole year.

The Relationship Between the Output of Copper for United States and World.

Table II contains the figures illustrating the relationship between the output of the United States mines and that of the remaining countries of the world, during the period of 1900-1913.

The proportionate output of the United States mines is seen to have remained unaltered at 55 per cent during the past three years, 1911-1912-1913. Although there have been slight variations in the percentage from year

TABLE II. RELATIVE PRODUCTION OF COPPER BY THE MINES OF THE UNITED STATES AND THOSE OF OTHER COUNTRIES, 1900-1913.

	United States		Other Countries	
Year	Tons	Per-centage	Tons	Per-centage
1900	263,500	55	216,012	45
1901	265,250	51	251,378	49
1902	292,870	54	248,425	46
1903	307,570	53	267,205	47
1904	365,050	56	278,950	44
1905	389,120	57	293,005	43
1906	409,650	57	304,450	43
1907	392,520	55	321,445	45
1908	423,300	56	330,880	44
1909	490,280	57	349,145	43
1910	484,935	56	370,750	44
1911	483,865	55	388,064	45
1912	554,360	55	452,750	45
1913	548,575	55	437,800	45

to year in the period 1900-1910, the percentage of the total world supplies of copper coming from American mines was the same in 1913 as in the year 1900, when the aggregate output was less than one-half the present total.

The Copper Output of the Leading Countries.

Table III gives Merton's figures for the copper production of the twelve leading countries (excluding United States) in the years 1900-1913, and is interesting, since it shows how Mexico, Japan, Russia, Australasia and Canada have come to the front in recent years as producers of the red metal.

The falling-off in the production of the Mexican mines in 1913 is due partly to the fall in price of the metal, but chiefly to the disturbed state of the country. The twelve countries named in these tables rank in the following order, when placed according to the importance of their copper output in 1913: Japan, Spain and Portugal, Mexico, Australasia, Chili, Canada, Russia, Peru, Germany, Africa, Norway and Servia.

Fluctuations in the Price of Copper.

Table IV gives the average price of standard bar copper in the period 1900-1913, compared with the output, and with the increase or decrease in production over the previous years. A close study of these figures reveals the fact that there have been three periods of high prices, and three periods of depression, during the 13 years, and that, judged by the previous experience of the copper market, the restricted

TABLE IV. THE WORLD'S OUTPUT OF COPPER COMPARED WITH THE AVERAGE PRICE FOR THE PERIOD 1900-1913.

Year.	Total Output.	Increase or Decrease.	Aver. Price Per Ton.
1900	479,514	7,270	$357.40
1901	516,628	37,114	330.30
1902	541,295	24,667	255.90
1903	574,775	33,480	281.60
1904	644,000	69,225	285.50
1905	682,125	38,125	339.60
1906	714,100	31,975	419.21
1907	713,965	—135	428.60
1908	754,180	40,215	291.70
1909	839,425	85,245	286.09
1910	864,275	24,850	277.80
1911	871,920	7,645	271.20
1912	1,006,110	134,190	355.10
1913	986,375	—19,735	331.90

output of 1913, is the prelude to another sharp fall in the price of the metal.

The relationship that exists between the output of copper by the producing companies, the stocks of the metal, and the price, was discussed at some length by the writer in an article published in the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for May 17, 1913. The last two paragraphs of that earlier article are reproduced below, for they summarize once again the writer's forecast of the situation, as regards prices, at the commencement of another year.

"The price of copper is subject to periods of boom and depression which are found, in their turn, to be dependent upon the relation between supplies and demand. When trade is good, the demand for copper increases; activity in the electrical engineering and shipbuilding industries especially, creating a great demand for the red metal. The varying level of the stocks at the refineries, and in the metal-brokers' warehouses, is the best guide to the relationship between supply and demand, and therefore to the price of copper. A study of the stock and price variations during the past three years brings out this feature of the copper market clearly.

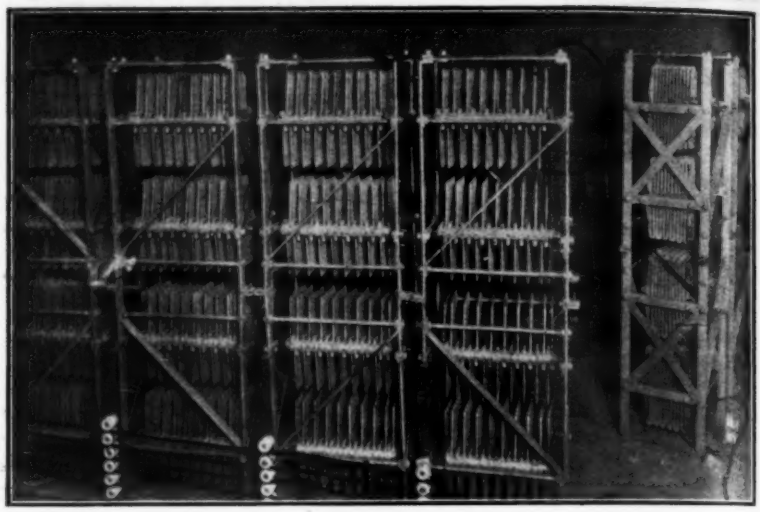
"At the present moment the tendency is for stocks to increase, and for the price to fall, and the writer is of opinion that this tendency will become more pronounced, as the year advances. Consumers of copper generally, and the electrical engineering industry in particular, would therefore be wise to adopt a hand-to-mouth pol-

TABLE III. THE COPPER OUTPUT OF THE LEADING FOREIGN COUNTRIES FOR THE PERIOD 1900-1913.

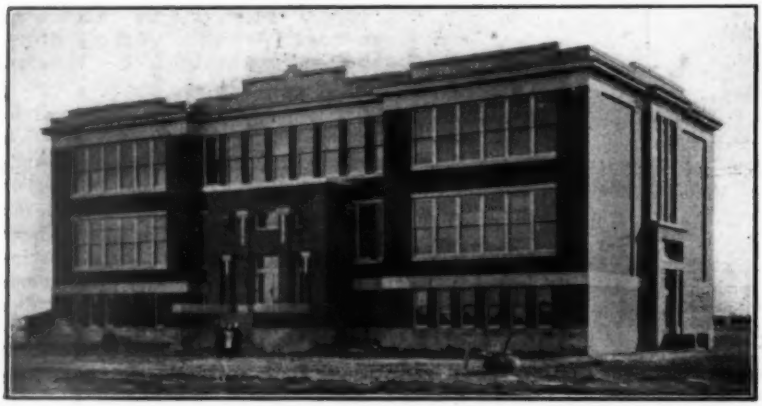
Year	Mexico	Japan	Spain and Portugal	Australasia	Chili	Canada	Russia	Peru	Germany	Africa	Norway	Servia
1900	22,050	27,840	52,872	23,020	25,700	8,500	6,740	8,220	20,410	6,720	3,935	.....
1901	30,430	27,475	53,621	30,875	30,780	18,800	8,000	9,520	21,720	6,400	3,375	.....
1902	35,785	29,775	49,790	28,640	28,930	17,485	8,675	7,580	21,605	4,450	4,565	.....
1903	45,315	31,360	49,790	29,000	30,930	19,320	10,320	7,800	21,205	5,230	5,915	.....
1904	50,945	34,850	47,035	34,160	30,100	19,185	10,700	6,755	21,045	7,775	5,415	.....
1905	64,440	35,910	44,810	33,940	29,165	20,535	8,700	8,625	22,160	7,740	6,305	.....
1906	60,625	42,740	49,320	36,250	25,745	25,460	10,490	8,505	20,340	6,980	6,120	.....
1907	56,565	48,935	49,675	41,250	26,685	25,615	15,000	10,575	20,490	6,800	7,010	.....
1908	39,990	43,000	52,585	39,500	38,315	28,570	20,085	15,000	20,200	6,880	9,190	2,140
1909	56,325	47,000	52,185	34,400	35,785	24,105	17,750	16,000	22,455	14,945	9,080	4,480
1910	61,515	46,000	50,255	40,315	35,235	25,715	22,310	26,945	24,710	15,205	10,425	4,845
1911	60,905	55,000	50,930	41,840	29,595	24,930	25,310	28,050	22,010	16,980	9,420	6,885
1912	72,455	65,500	58,930	47,020	37,305	34,710	33,010	26,065	25,220	16,370	10,980	7,240
1913	51,980	72,000	53,835	46,580	39,385	34,365	33,240	25,310	24,910	22,510	11,610	6,275

icy in their purchases of this metal, and to keep their stocks of copper at the lowest possible limit, consistent with the requirements of their business."

. The tendency for stocks to increase was held in check up to October, 1913, but since that month, when the total visible supplies in Europe and America amounted only to 40,365 tons, there has been a decided rise in stocks and fall in price, and at the moment the outlook for the producers and holders of the metal is less favorable than it was 12 months ago. Whether the sharp fall in the price of the metal from its high level of $355.60 on October 31, 1913, to $306.10 on March 31 of the present year, will be continued for another six months, remains to be seen, but with the declining trade and political complications in more than one country consuming large quantities of the metal, it would not be surprising if copper fell to the low level of 1911 before the close of the present year, and could be bought for under $300 per ton.



Electric Heaters, Showing About One-Half of Total Installation.



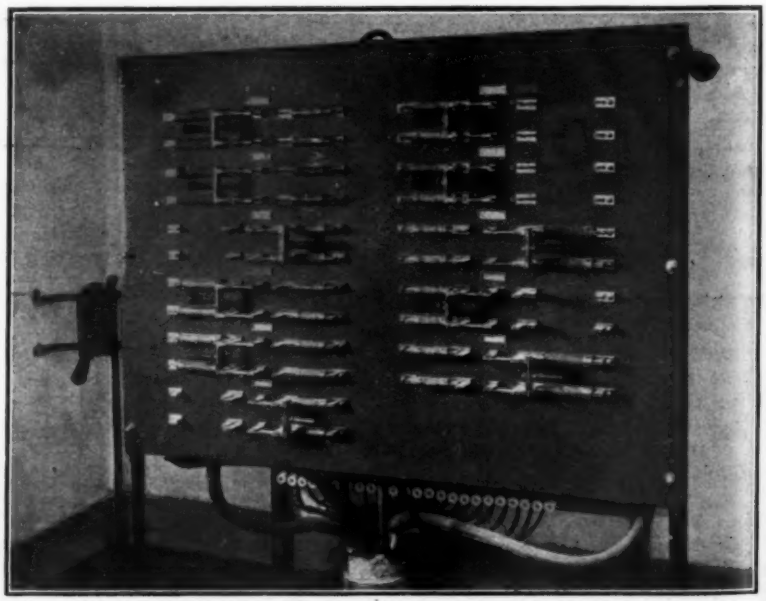
Rupert High School.

The Electrically Heated High School at Rupert, Idaho.

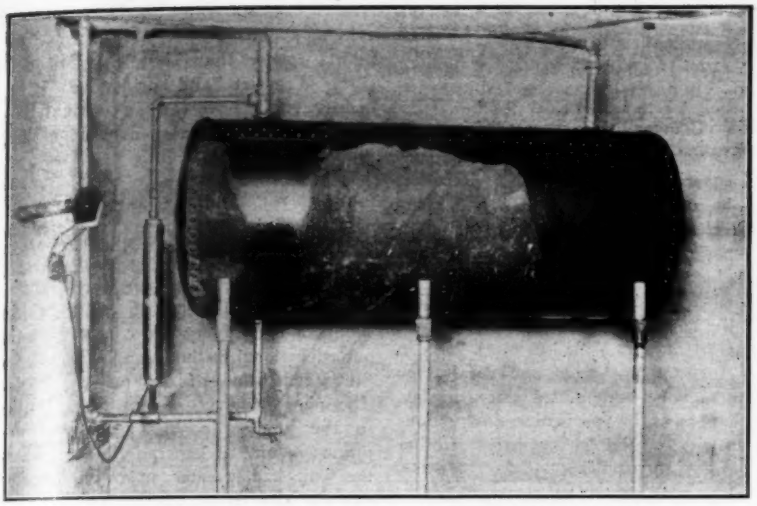
The Rupert High School building is a two-story brick structure with a large basement. It contains a good-sized auditorium, a gymnasium 39 by 70 feet, lockers, shower baths, etc., and 14 class rooms, including a thoroughly electrically equipped domestic-science room and chemical and other laboratories.

The heating system is probably the most interesting feature of the building and is attracting great attention because it is entirely electrical. It is probably the only system of the kind installed in the United States and consists of 22 units of resistance grids, a type peculiar to the manufacturer, the Simplex Electric Heating Company, of Cambridge, Mass. These grids are installed in a small room in the basement and the air from outdoors is taken through them by the use of a large Sturtevant blower, having a capacity of 20,000 cubic feet per minute.

The temperature of the room in which these heaters are installed does not run above 78 degrees Fahrenheit and the different class rooms into which this warmed air is blown are maintained at an average temperature of about 70 degrees Fahrenheit. After it passes through the heaters, the air is carried into another small room, which has about six inches of water in a pit on the floor; the air striking the water is thus washed and the proper humidity given to make it most comfortable in the class rooms. The air is distributed through metal ducts in the basement and brick risers in the walls, and both fresh and foul air ducts are provided for each room, thus combining the heating and ventilating systems.



Panel Controlling 400-Kilowatt Heating Installation.



Water Heater and Hot-Water Tank Holding 250 Gallons.

These air ducts are so arranged that the entire capacity of the heating plant can be diverted into either the auditorium or the gymnasium, or these two rooms can be cut off when not in use and any portion of the heated air diverted to any part of the building.

The control of the heating units is obtained through a switchboard located in the superintendent's office. It is possible to use as low as 9 kilowatts and any amount above this up to 400 kilowatts, which is the total capacity of the plant, thus giving 40 heat variations.

A 400-kilwatt Westinghouse transformer is located in a special room at the right side of the heaters and double-throw switches on the switchboard allow the use of 440 volts when the blower is running; an electric device will trip the oil switch of 400-kilowatt capacity and thus cut off the entire heating system, if for any reason the blower ceases to work. After school hours, when the blower is idle, the switches are thrown onto the other side of the circuit giving 220 volts, thus providing against overheating of the units, as well as eliminating the necessity of constantly running the blower.

Hot water is provided for the school house by means of a Simplex three-kilowatt circulating water heater attached to a 250-gallon tank; this is proving ample for all requirements of the building, including the shower baths, domestic-science department and laboratories.

The domestic-science department has an equipment for 20 pupils; it consists of 4.5-inch Simplex disk stoves, and with each stove is a frying pan and a double boiler. The domestic-science teacher in commenting on this equipment states, "The utensils are very pretty and the girls enjoy them very much." She further states, "I know that electricity is much cleaner and so far as my experience goes here I believe it is just as quick when used with the Simplex stoves, which have a locking device which makes them heat very quickly anything in their own utensils." As many of the pupils come from long distances, the Board of Education has provided also a cafeteria where luncheons are served to the pupils.

The school and its electric heating plant have been in operation since early in the year. The equipment is proving highly satisfactory in every respect. Although the capacity of the heating system, as above stated, is 400 kilowatts, the average power consumption in cold weather has been less than 300 kilowatts.

A feature of this installation that merits special notice is the fact that the heat is available instantly and continuously at all times. This makes the building especially available for a general meeting place or "community building."

Domestic Science Room.

Additions to Staff of Society for Electrical Development.

The Society for Electrical Development, Incorporated, in selecting its staff has chosen, among others, John P. Mallett, a member of the American Institute of Electrical Engineers, whose duties will be to investigate the application of electricity for the various industries and to suggest further applications. The information thus gathered will be filed and indexed for the benefit of the members of the Society.

Mr. Mallett is a graduate of Tufts College, where he took a course in electrical engineering. His experience includes six years with the Westinghouse Electric & Manufacturing Company, eight years as chief engineer of the Northern Electrical Manufacturing Company, and five and a half years as engineer in charge of the department for the development of special apparatus for commercial and government work at the Diehl Manufacturing Company. His experience qualifies him for the important work which the Society is entrusting to him.

The information collected by Mr. Mallett, together with all other available information on the subject of the uses of electricity for light, heat and power, will be taken care of by the Commercial Exchange Bureau, which will be in charge of Theodore Dwight, who will conduct the correspondence upon such subjects, both with the members of the Society and with the general public seeking information. Mr. Dwight was formerly assistant to General Griffin and was for some years assistant secretary of the American Institute of Mining Engineers, during which time his work has been of such a character as to render him particularly competent to take charge of the Society's Commercial Bureau.

James Smieton, Jr., has been engaged as office manager and acting secretary-treasurer of the Society.

Other members of the staff are being secured and the Society expects to commence its active work immediately.

BOOK REVIEWS.

"Switchgear and the Control of Electric Light and Power Circuits." By A. G. Collis. New York: D. Van Nostrand Company. Cloth, 85 pages (4x6½ inches), 47 line illustrations. Supplied by the Electrical Review Publishing Company Incorporated for 50 cents.

This book deals with English practice. It was written by the author of "High and Low-Tension Switch Gear Design." There are four sections. Two deal with direct-current practice and two with alternating. It is a popularly written, pithy, little treatise containing practically no mathematics, although some relatively simple formulas are used for explanatory purposes in the text and there are a couple of pages of general electrical formulas at the back. The book was, evidently, particularly written for those who occasionally purchase and for those who operate switchgear. It recounts certain fundamentals upon which the selection, arrangement and operation of switching and control apparatus must be based. It briefly outlines the operating principles and construction of the more important switchgear components such as switches, relays, instruments, fuses and the like. Complete switchboard and control outfits are given some attention. Some of the suggestions relating to mining installations are particularly good. While, as suggested, the book deals exclusively with English and possibly Continental practice, there is much information in it that should prove useful to the practical electrical man in America. TERRELL CROFT.

"The Universal Electrical Directory." Thirty-third Edition. London: H. Alabaster, Gatehouse & Company. Cloth, 1,548 pages (6x9½ inches), illustrated. Supplied by the Electrical Review Publishing Company Incorporated for $5.00.

The 1914 edition of this valuable reference volume contains 34,515 names. It contains alphabetical and classified directories for Great Britain, Continental Europe, United States, and Colonial and general, covering the remainder of the world. There is also a geographical directory in the British section. The volume is of especial value for the British section. The list of central stations in this portion has details as to the nature of the supply, system of distribution, capacity of plant, frequency, voltage, and name of chief engineer. The portion of the directory dealing with the United States will not be of much value to American readers, as it is less complete. The classified section is ludicrously incomplete, some of the largest manufacturers in the various lines being omitted from the list; some entries are absurdly inaccurate. A complete revision of the American section is highly desirable before another edition is published.

"Electric Toy Making." By T. O'Conor Sloane. Twentieth edition, revised and enlarged. New York: The Norman W. Henley Publishing Company. Cloth, 210 pages (5x7 inches), illustrated. Supplied by the Electrical Review Publishing Company Incorporated for $1.00.

This volume is intended for amateurs and covers the more simple devices that can be made from electrical and magnetic elements. Effects depending upon alternating or rotating fields are not included. Many of the toys described are, nevertheless, interesting and amusing and the boy who is not very familiar with electrical matters will find much help in the instructions given. Several new chapters have been added since the last edition and the particular instructions given will probably be suggestive of other things to the reader.

"Craig's 'Q & A' Book. Questions and Answers About Electrical Apparatus." Rewritten and revised by James W. Craig and William P. Woodward. Third Edition. Pittsfield, Mass.: Berkshire Technical Publishing Company. Flexible leather, 254 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company Incorporated for $1.50.

This volume puts in the form of questions and answers a great deal of information regarding electrical matters and illuminating engineering. There are 13 chapters with the following headings: Systems, Illuminating Engineering, Incandescent Lamps, Arc Lamps, Direct-Current Motors, Alternating-Current Motors, Constant-Potential Transformers, Constant-Current Transformers, Mercury-Arc Rectifiers, Meters and Instruments, Interior Wiring, Exterior Wiring, Central-Station Operation and Apparatus. The material is comprehensive and well written and the information is dependable. Many practical questions that come up to the electrician not familiar with some one of these particular fields are answered in an understandable way. The present edition has been much enlarged and revised and should prove of great value in its field.

"Gear Cutting in Theory and Practice." By Joseph G. Horner, Manchester, England: Emmott & Company, Limited. Cloth, 392 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company Incorporated for $2.00.

This book will be of value to the machinist, designer and mechanical engineer. The 18 chapters are grouped in four sections dealing respectively with Principles of Design; Methods of Cutting; Machines; and Materials, Manufacture and Strength. An appendix contains useful tables of pitch, pitch angles, etc. The illustratoins are profuse and mathematics has been largely avoided, the aim of the author evidently being to cover practical points rather than the theory of design. Practice and principles have been related, however, and recent developments in practice covered. The typography is excellent.

"Bill's School and Mine." By W. S. Franklin. South Bethlehem, Pa.: Franklin Mac Nutt and Charles. Cloth, 98 pages (4¾x7 inches). Supplied by Electrical Review Publishing Company for 50 cents.

This is a collection of essays which should interest every one concerned with our educational methods, and especially in the regeneration of our public schools. The introductory essay, giving title to the volume, contrasts present conditions with a generation ago when the boy had greater opportunities for outdoor activities and especially for contact with nature. An essay on the study of science deals more especially with technical education. This essay is intended to convey some idea as to the necessity of rigorous thinking in modern human affairs, and to lead young men to a point of view from which this necessity looms up as the biggest thing that confronts them in their chosen field of science and technology. The exactions which are placed upon young men by the technical school are by no means artificial and unnecessary, they are demanded by the conditions of modern life and it is impossible to escape them.

The Solution of Terminal Freight Congestion.

At the April meeting of the Electric Vehicle Association of America, Fred A. Hortter, car accountant of the Boston and Maine Railroad, called attention to the inefficient means of handling and delivering freight at terminals in a paper entitled "The Problem of Terminal Freight Congestion and Its Solution." His observation of the terminal yard teaming in the Boston and Maine railroad yards in Boston showed that in one day 10,264 horse-drawn vehicles handled freight to the outbound freight houses, the average load on a five-ton vehicle being 0.36 ton.

Electric vehicles are replacing horse-drawn teams in many cases but it is merely an improvement in means without change in the methods. The necessity for some systematic method of handling this freight is apparent. This he believes can best be accomplished through a consolidation of the railroads and trucking interests as recommended by Metropolitan Improvement Board of Boston in 1907. By establishing clearing stations in the business sections and by arranging schedules so that trucks will always be reasonably loaded, a greatly improved efficiency can be obtained.

New Electrical and Mechanical Appliances

Effective Electric Window Displays.

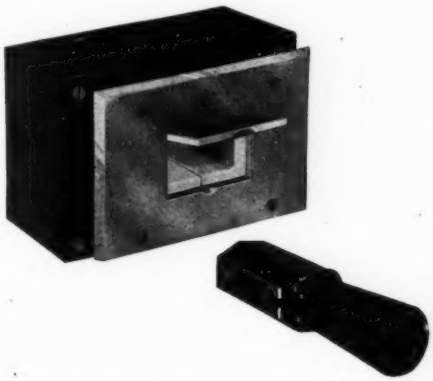
The Western Electric Company has been keeping the windows of its store at Cincinnati, O., busy helping to advertise the company's goods, either generally or specifically. An instance of the latter sort was a recent clever display featuring electric fans. Several of these were so placed in the window and turned on as to keep in constant motion a large quantity of white confetti, which was piled in the window, the effect being that of a very realistic snowstorm. The suggestion of coolness was irresistible and, although the weather was still rather cool, many people were moved to purchase fans against the warmer times coming. Another device being used by the company regularly is an electric scoreboard, by means of which passing baseball enthusiasts are enabled to keep tab on the way the game is going when the Cincinnati "Reds" are playing. There is an illuminated blank for each inning, which is filled in with the number of runs made, or with an illuminated zero, as the case may be.

New Ralco Receptacle, Box and Cover.

To meet the demand for a flush power plug and receptacle suitable for vacuum cleaners, washing machines, heating appliances, stereopticons, etc., the Central Electric Company has added to its Ralco line a new design known as the No. 7B flush receptacle and plug. This is rated at 30 amperes, 250 volts.

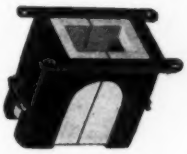
The box is made of gray cast iron and has ample room for quick installing of the conduit. It is arranged with four knockouts for three-fourths-inch conduit. The cover is a gray iron casting and is three-fourths-inch deep in order to make easy its installation. The front of the box is lined up with the outside surface of the studding, and the cover is of the usual thickness of wood lath and plaster or baseboards. Special covers for metal lath and plaster work are furnished on request.

The receptacle consists of the well known 30-ampere Ralco nonreversible porcelains and contact that are rigidly held in place by suitable yokes. The face plate seats into the cover, and when seated is flush with the plastering. A suitable flush brass plate is then attached to the cover. Special plates can be finished to match the hardware.



New Ralco Receptacle and Plug.

7-B COVER



7-B RECEPTACLE

7-B PLUG

7-B BOX

7-B PLATE

Parts of the New Ralco Outfit.

As an opening for the plug, a door is cut into the flush plate which closes by gravity. These plates can be equipped with hasps and padlocks, if desired. This receptacle was designed so that in installing, all work is done from the front. The plug used is of the No. 2 nonreversible type.

The manufacturer, Central Electric Company, 326 South Fifth Avenue, Chicago, Ill., has given much attention to the development of its Ralco line of heavy-current plugs and receptacles and is prepared to furnish on request literature relating thereto, now in course of preparation.

British Telephone Activity.

Electric cable-making firms in England are enjoying a boom at present. This is partly due to some exceptionally large contracts for railway cables for Australia and Argentina, but it is largely accounted for by British Government telephone developments. Official information shows that the post office has on order telephone cables containing 28,550 miles of single wire for London and 369,400 miles for the provinces, the value being $6,630,000. For London, 146 miles of single underground conduit, and for the provinces 1,869 miles, are on order, to cost $2,165,000. Central-battery equipments for London $1,200,000, and for the provinces $550,000, as well as automatic for London $21,900, and for the provinces $750,000, are other matters placed by the post office in connection with works in progress.

Telephone Between London and Berlin.

It is expected that telephone service between London and Berlin will become possible when the submarine telephone cable between England and Holland has been laid. This cable will be 79 miles long, of the four-core Pupin loaded type. Its terminals will be at Aldeburgh and Walcheren. It will be the longest submarine telephone line yet laid.

Electrotechnical Commission.

The International Electrotechnical Commission will meet at San Francisco in 1915 and in St. Petersburg in 1917. The various committees meet in Madrid this year.

New Type of Small Outdoor Substations.

The possibility of increased revenue for central-station systems from taking on the small consumer located in the vicinity of transmission lines has brought into existence the small outdoor substation. The General Electric Company, Schenectady, N. Y., has devoted much effort to perfecting this type of apparatus and is now prepared to furnish such equipments in capacities ranging from 3 to 40 kilovolt-amperes from 2,300 to 110,000 volts.

Expulsion Fuse Block for Outdoor Substation, 15,000 Volts, 50 Amperes.

The initial expense of the equipment has been made as low as possible without sacrificing dependability. The maintenance charges have been cut to a mimimum by the use of rugged and simple parts in the design.

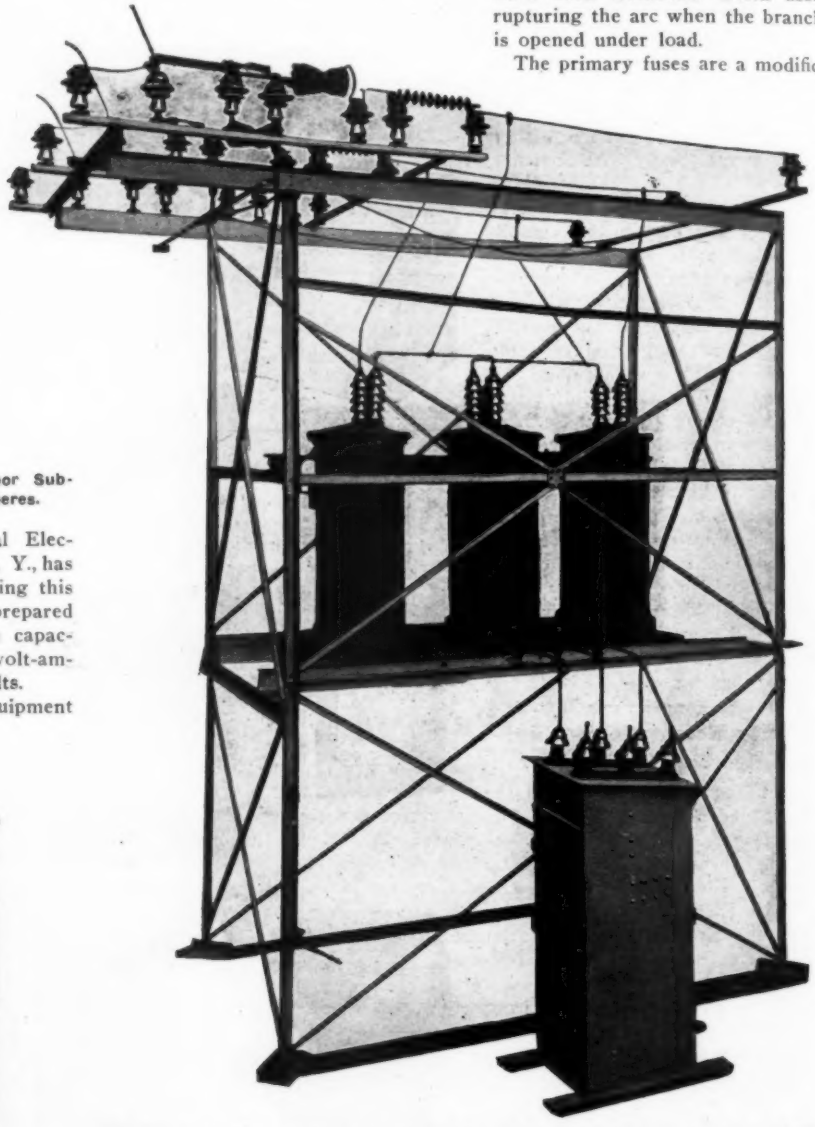
These equipments are made in a great variety of designs and can be mounted on wooden poles, wooden towers, or steel towers, according to the requirements imposed by the capacity and voltage of each installation. The substations usually include, on the primary side, switches, choke coils, fuses, and transformers; while, on the secondary side, the equipment varies from one comprising oil switches, watt-hour meters, current and potential transformers to that of merely a lever switch with fuses.

Steel Housing for 2,300-Volt Secondary Switch, Meter, Etc.

The primary switches are of the air-break type and are made up in three designs; one in which the switch opens upward and is operated by hand or by a motor located below the switch blades, usually at the bottom of the pole; another where a lever switch opens downward, being operated by the usual switch hook; a third type whose contacts move in the direction of the line, and which is operated manually or by a motor. The high-voltage switches have horn deflectors which assist in rupturing the arc when the branch line is opened under load.

The primary fuses are a modification of the expulsion type and are designed either to take the place of the primary switch, being mounted vertically and making contact with clips in closing like the ordinary knife switch, or are for horizontal mounting without the switch feature. They are made up in three-pole units and are operated from the ground by a rod or a rope.

The transformers are single-phase and designed especially for outdoor

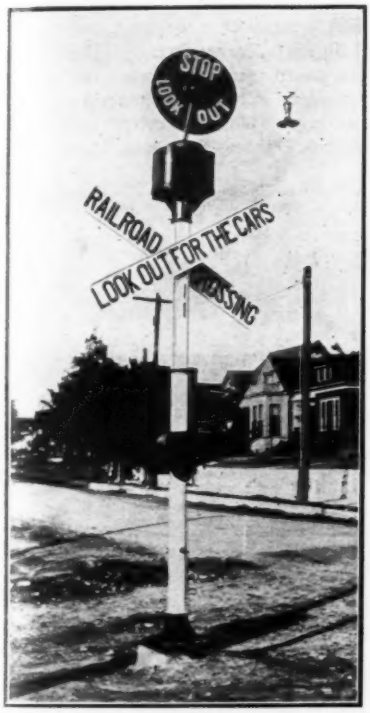


Outdoor Substation Complete for Distributing 220 Kilovolt-Amperes from 35,000-Volt Transmission Line.

service. The choke coils are of the hour-glass type, or of a new design known as the suspension type.

For the secondary circuit the oil switches, watt-hour meters, etc., are of standard construction for indoor service suitable for mounting on a panel in a wooden or steel house and are furnished completely wired.

Two styles of houses are avilable. In the one, a slate or steel panel carries an oil switch provided with a series trip coil for protection from overloads and also a watt-hour meter, the current and potential transformers being mounted on the side walls and the buses attached to the roof. In the other style (used for 440-volt distribution) a comparatively small house, suitable for mounting on a pole of the transmission line, is used. This house contains a small panel mounting a lever switch and inclosed fuses, the latter for overload protection.



Electrically Operated Automatic Flagging Device.

A pole-type regulator can be supplied with the above equipments, if desired, to maintain constant potential.

The Automatic Flagman.

The "Automatic Flagman" is a device to protect railway grade-crossings by giving effective warning of the approach of trains. In these days of automobiles, something more than the old "Stop, Look and Listen" sign is necessary. Such signs are too unobtrusive to attract the attention of the motorist going at 60 miles an hour, and at night they are practically of no real value.

But the "Automatic Flagman" cannot be accused of being too modest. At the approach of a train it rings a loud gong and waves a bright red disk by day and a red lamp by night. So sensitive is the human eye to red and to motion, that such a warning can hardly escape notice.

As shown by the illustration, this device consists of a weatherproof case containing the operating mechanism and the signal disk upon which are mounted standard ruby-red switch lenses with an incandescent lamp between. Energy is supplied by a small Westinghoues electric motor which operates the mechanism that rings the gong and waves the disk.

The motor receives its energy from storage batteries, lighting circuits, or trolley circuits, depending on the character of the installation. On steam roads, the track is insulated and bonded for the desired distance away from the signal and is charged with current from a small battery. The train on entering this block completes the circuit and operates a relay, which connects the motor with the power circuit. When the train leaves the block, the circuit is opened and the motor disconnected. On electric roads, the motor is connected to the trolley circuit by a contactor which is mounted on the trolley wire or third rail and is operated by the car as it passes; a second contactor disconnects the motor when the car passes the signal.

The device is manufactured by the Automatic Flagman Company, Los Angeles, Cal., and the illustration shows an installation on the Pacific Electric Railway at Los Angeles. This particular machine, which is one of several hundred "Automatic Flagmen" on the lines of this railway, operates about 300 times a day.

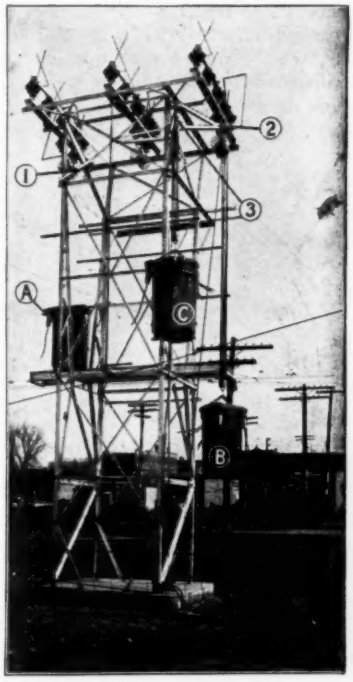
Handling Transformers on Steel-Tower Substations.

One of the problems confronting the central-station managers using steel-tower outdoor high-tension substations is the economical handling of transformers. However well a station may be designed to control and protect transformers, it falls short of commercial requirements if the method of handling transformers is difficult. This is especially true in case of transformer failure when service is interrupted and customers inconvenienced.

The latest development in outdoor stations to meet conditions as encountered in commercial practice is shown in the accompanying illustration. The switching and protective units are of standard form. The method of handling transformers, however, is unique, effective and low in cost.

This station is equipped with a transformer platform provided with a transfer truck, which can travel the full length of the I-beam supports. Near the top of the front corner posts are pivoted single and double jib cranes indicated as *1*, *2*, *3*. These jib cranes which have a large radius of action are provided with steel U-bolts to take the tackle hooks. The method of handling transformers is well shown in the accompanying illustration.

Assuming that the middle transformer *B* has failed and must be removed, the end transformer *C* is first raised by means of the No. 3 jib crane, swung around out of the way and left hanging on the tackle. The transfer truck with the middle transformer *B* is next rolled to the end of the platform, the transformer being raised with jib No. 2, swung around and lowered to the ground.



Handling Transformers on Outdoor Substation.

To restore service transformer *C* is swung around and lowered to the platform, the station now operating in open delta until the defective transformer can be repaired or another substituted. By this combination of transfer truck and jib cranes, transformers of any weight up to 4,000 pounds can be handled.

The particular installation shown has been started with three 30-kilowatt, 22,000-volt, 25-cycle transformers, and when the load increases sufficiently three 50-kilowatt units will be used, in place of the transformers now in service. These outdoor substations are manufactured by the Delta-Star Electric Company, Chicago, Ill.

A TIME-SIGNAL TRANSMITTER.

By Alfred Gradenwitz.

The International Time Conference which met in Paris in October, 1912, decided that from July, 1913, the radiotelegraphic international time signals should be altered in accordance with the scheme in Fig. 1. As however such a long series of signals could not possibly be given out with sufficient accuracy by an operator observing a clock and handling at the same time a manipulator, special apparatus had to be devised to actuate automatically and with a maximum of precision the wireless stations entrusted with the time service.

The Paris Observatory therefore approached Edouard Belin of the same city, who designed the apparatus described below which has been in operation since July last. It is based on a principle which has long been used successfully for other applications, and is mainly designed on the following lines:

The apparatus is always ready to work, but so far from being a clock or time-keeper, it is an automatic mechanism set in motion by the accurate control of a master clock, or a synchronized intermediary clock, provided with convenient disengaging devices. It normally requires no time adjustment and depends for its accuracy entirely on the controlling clock.

This merely mechanical apparatus is synchronized at ten seconds interval, by a clock producing a current break every two seconds. The transmission of signals is produced by the sudden opening of a high-precision interrupter, the working of which only requires a negligible amount of energy. When the transmission of signals has come to an end, the motive weight is automatically wound up again by an electromotor, the apparatus returning of its own accord to its initial position. At this moment all the circuits are opened and the apparatus, adujsted for the next set of signals, does not use up any energy in the meantime. The adjustment can be effected with remarkable precision (to about one-thousandth of a second), and the duration of signals can, if required, be altered by means of a micrometer button. The working of the apparatus is kept up by two small storage batteries, having a capacity of 20 ampere-hours, which need only be charged two or three times per month.

Master Clock. When the master clock is used alone, it serves, on the one hand, to disengage the signal distributor at the proper moment, and on the other, to ensure a uniform working of the apparatus by a convenient synchronizing arrangement. The former effect is obtained by an arrangement similar to that of the Leroy clocks used for the transmission of signals from the Observatory to the Eiffel Tower.

The hour hand, the minute hand and finally the second hand release in succession a set of levers which are so arranged that the first prepares the working of the second, while the second allows the third to fall into a notch just at the proper moment, thus closing a working circuit.

The synchronizing effect is generally produced by an electric contact controlled by the motion of the pendulum. However, in order to insure the accuracy desired, the synchronizing current is, in the present case, only sent out every two seconds.

The disengaging and synchronizing contacts both act on the same sensitive relay, no current passing through the circuit before the beginning of working.

At 55 minutes 56 seconds, the disengaging contact is closed, thus preparing the passage of the current to be produced one second later by rupture of the synchronizing contact. The relay is then actuated for the first time and the armature of an electromagnet releases the stop, liberating the apparatus and allowing the motive weight to begin working.

When ten seconds later, the second stop arrests the apparatus, the disengaging contact has long been broken and the synchronizing current, due to the automatic closing of an interrupter controlled by the working of the apparatus, acts for the second time, thus leaving between each two actions a strictly constant interval of ten seconds.

The disengaging contact acts by closure, because of its length and the fact that its origin requires no absolute precision; the synchronizing contact, however, acts by rupture, its action being both very short and precise.

Signal Transmitter. The signal transmitter mainly comprises a steel cylinder carefully centered on ball bearings. On this cylinder is traced a square thread of spiral shape which comprises relief parts just corresponding to the signals to be given out.

On this horizontal cylinder or distributor and on a guide constituted by two V-shaped steel bars, there moves a carriage comprising a projection fitting into the square thread. The rotation of the cylinder thus imparts to the carriage a rectilinear motion in exact correspondence with its own.

The carriage carries an interrupter or translator constituted by a light plate resting on a micrometer contact and carrying a very hard point. This interrupter is normally closed, but when a complete projection passes in front of the point, the plate is lifted very slightly from the micrometer contact and the circuit—or at least the corresponding branch—is opened. As soon as the projection has passed the interrupter closes again, experience having shown this organ to work with a precision exceeding all expectation.

Fig. 1.—Scheme of International Time Signals.

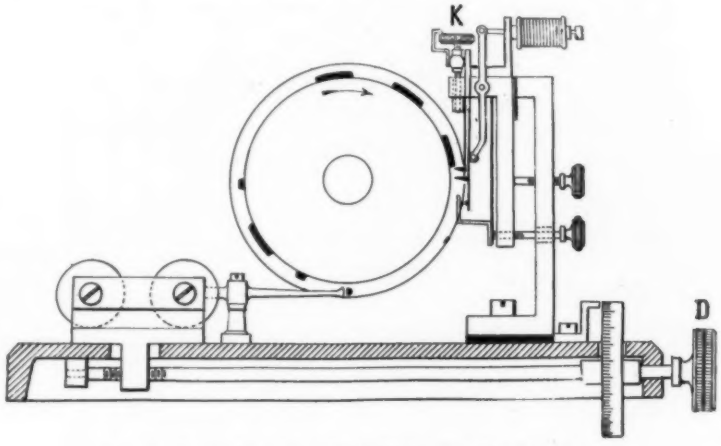


Fig. 2.—Cross Section of Distributor and Translator.

As a matter of fact, the translator comprises not one, but two light plates parallel to one another and connected up in parallel. One of these plates is immovable, whereas the other can be raised or lowered by means of a micrometer screw. As each plate carries a sapphire, three cases have been provided for:

First, when the two points coincide with the same generatrix of the distributor, they will act like a single one.

Second, if the movable plate is in advance of the fixed plate it will finish all signals commenced by the latter,

Third, if the movable plate lags behind the fixed one, the opposite will be the case.

This allows the absolute duration of signals to be regulated with extraordinary accuracy.

The translator could be mounted direct in series with the line and the relay of the radiotelegraphic station. Since, however, the required current translator is opened, the current takes an equal but negative intensity.

This current reversal by mere rupture constitutes, as it were, an electric antagonistic spring which only exists as long as it is needed. This doubles the sensitiveness of the relay and insures an absolutely reliable working. The synchronizing relay is arranged in the same manner.

The distributor is actuated by a weight, its uniformity of working being warranted by a proper regulator. However, since an absolute uniformity cannot possibly be obtained, the accumulation of accidental errors is prevented by synchronizing.

To this effect the cylinder axle carries a plate fitted with two stops striking against the armature of the electromagnet, which is traversed by the local current of the first relay. The motion of this armature under the action of the controlling clock disengages every ten seconds, the apparatus being stopped for a negligible time.

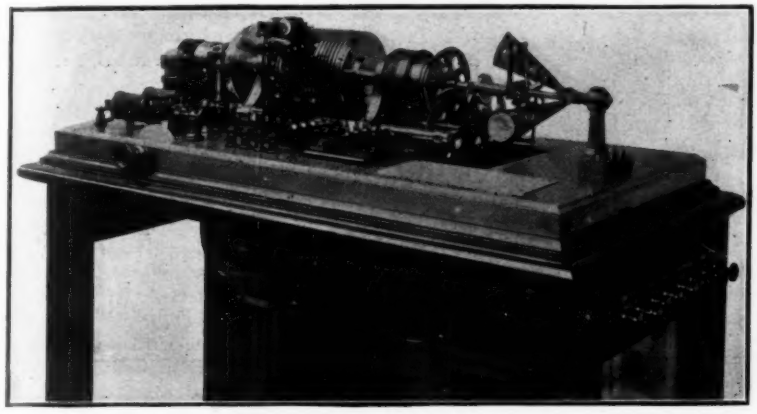


Fig. 3.—View of Distributor and Translator.

intensity is 100 milliamperes, the breaking spark would deteriorate the contact very quickly, thus getting the apparatus out of order. This is why a relay has been inserted at the starting station and arranged to be controlled by the translator alone, the local current of this relay actuating that of the radiotelegraphic station.

While this first relay could be connected up in series with the translator, M. Belin has thought it preferable to adopt an arrangement increasing considerably the safety of working of the (polarized) relay.

The translator, shunted through a resistance of 250 ohms, is arranged in place of the resistance to be determined in a Wheatstone bridge, the three other branches of which are each of 10 ohms, the relay being substituted for the galvanometer. When the closed translator short-circuits the 250-ohm resistance, the current traversing the relay under these conditions has a given positive intensity, and when the

The exact time of the beginning of signals, of course, depends on the relative position of the distributor and the translator points. If the armature of the synchronizing electromagnets be lagging, the cylinder will be fast, until the synchronizing stop has been arrested by the armature. If the opposite is the case, the cylinder will be slow.

The synchronizing electromagnet and its armature are fixed on a small plate, arranged to advance or recede slightly in a very precise guide. This motion is controlled from outside by means of a tangent screw and an axis carrying a graduated drum, each division of which corresponds to an advance or lag of one one-thousandth of a second. The weight is wound up by means of a small electromotor of precision, working under a tension of six volts.

The apparatus has been arranged to give out, whenever required, all sorts of additional optical signals during the minute preceding transmission of the time service.

Work on the Caimito Radio Station.

The footings for the 600-foot steel towers of the Darien radio station at Caimito, C. Z., are about half completed. Tower No. 1 will be about 1,500 feet east of the east banks of the Panama Canal; two No. 2, approximately 896 feet north of No. 1; and No. 3, approximately 765 feet from No. 2, and about 982 feet from No. 1. The depth of excavation for the footings has varied from 12 to 28 feet below the surface of the ground, the concrete bases themselves being rectangular in plan, 16 by 20 feet, and 10 feet deep. Each tower is triangular in cross-section, each side of their bases being 150 feet in length. The location and details of the power house, operating building, and quarters for the officers in charge are subject to further consideration before approval. The contract for the fabrication and erection of the steel for the towers at Caimito, was awarded to the Penn Bridge Company, of Beaver Falls, Pa., the subcontract for the erection of the towers being awarded by the Penn Bridge Company to the Central American Construction Company.

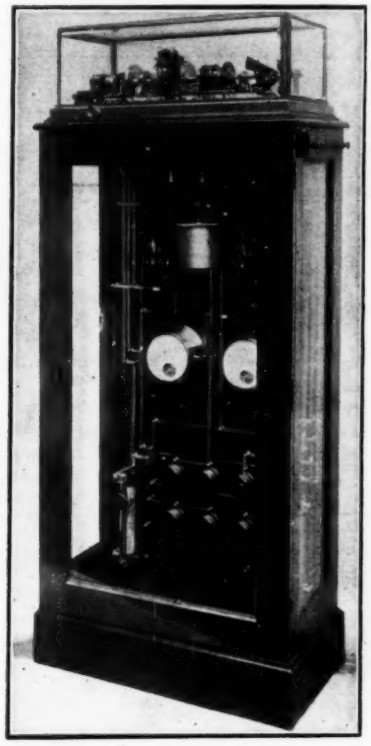


Fig. 4.—General View of Time-Signal Apparatus.

Inverse-Time-Element Relays.

Alternating-current power relays close their contacts under conditions of overload or of reverse power. They are of three different characteristics each having the inverse-time-limit feature: (a) overload and reverse power; (b) overload only, instantaneous or adjustable definite minimum time at heavy overloads; (c) reverse power only, instantaneous or adjustable definite minimum time at heavy overloads.

Fig. 1.—Overload Relay Complete.

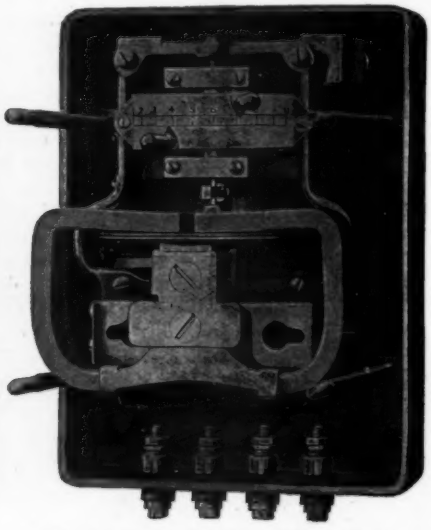


Fig. 2.—Overload Relay without Cover.

In principle the overload-and-reverse-power relay consists of contacts closed by an induction-type alternating-current instrument, in which are combined the functions of ammeter and wattmeter, tripping at heavy overloads and on low reversed power. At zero voltage the relay acts as an ordinary current-actuated overload relay, and therefore low power-factor or absence of voltage does not prevent it from tripping.

The relay is operated from voltage and current transformers of 100 volts and 5 amperes on the secondary. The contacts close a direct-current tripping circuit. This has an adjustable inverse-time-element. The maximum time-element setting for any given tripping-load setting is about ten seconds and the minimum about one second, the maximum having instantaneous tripping action at heavy overloads.

Three adjustments are provided, one for regulating the ratio of the reverse to the overload tripping current, one for regulating the absolute values of these quantities, and the third as described above for regulating the value of the time element. The relays can be adjusted to operate at from 6 to 14 amperes in normal direction and from 0 to 4 amperes reverse power with normal voltage.

The plain overload relays, Figs. 1 and 2, are similar in principle to the overload-and-reverse-power relays, but the voltage connection is omitted. The instrument, therefore, acts as an induction ammeter. In Fig. 3 curve *A* shows the time-element characteristic of these relays. The definite minimum, curve *B*, is obtained by means of Westinghouse "torque compensators" used as an auxiliary to the overload relay. The torque compensator reduces the torque of the relay at heavy overloads without reducing the torque at light overloads and by using it with the relay, the latter can be adjusted for any definite minimum time from 0 to 2 seconds at heavy overloads in the standard relays. Fig. 4 shows the minimum and maximum time-element curves of the overload relay. These curves are modified in the manner shown in Fig. 3 by using in connection with the relay a torque compensator.

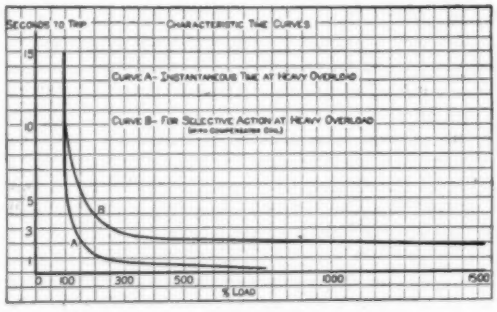


Fig. 3.—Characteristic Curves of Type C Relay.

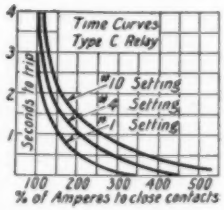


Fig. 4.—Curves of Time-Element Adjustment.

Two adjustments are provided, one for regulating the value of the time element between the limits shown in Fig. 4, and one for determining the minimum current at which the relay is to operate. The minimum current at minimum time setting can be adjusted from 3 to 5 amperes, and at a maximum time setting for from 3 to 8 amperes.

The relay for reverse power only is a combination of the overload-and-reverse-power relay movement with a selective wattmeter element that keeps the trip circuit open when power is flowing in the proper direction. This removes the overload feature of the main relay and allows the instrument to close the circuit only on reverse power. It does this, even should the voltage or power-factor drop to two per cent of normal, in other words, even if the true watts in the reverse direction drop to two per cent under short-circuit conditions. Power flowing in the normal direction equal to two per cent or more normal prevents the relay from tripping. The time-element characteristics of the reverse-power relays are the same as those of the plain overload relays, and the same adjusements are provided.

An important feature of all these relays is their inherent accuracy in time characteristics. Relays controlling circuits operated in service can be safely set one-half second apart and will act selectively even at extremely high overloads. The operating characteristic of many circuit-breakers will allow this setting to be as close as one-third second. The resetting feature is so well worked out that should the overload in any relay be interrupted for 1.25 second short of the time the relay is set to operate, the movement will return to its starting position without closing its contacts. These features, combined with the wide range of time characteristics, make selective action feasible in a manner entirely impossible in other forms of relays.

The relays described above are manufactured by the Westinghouse Electric & Manufacturing Company.

Wireless Telephone Communication With Moving Train.

On May 1 a very successful test of wireless telephone communication between the Lackawanna Limited train and the Scranton, Pa., station was effected while the train was rushing on at a speed said to be about 50 miles an hour. Communication was maintained until the train reached Stroudsburg, Pa., 53 miles from Scranton. The wireless equipment used included an amplifier invented by Lee de Forest, which is said to make possible amplification of speech 50 times above normal. L. B. Foley, superintendent of telegraphs of the Lackawanna system, is continuing the tests and hopes to be able to greatly extend the range of wireless telephony with trains.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

AUTO-STARTERS.—Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo.

"Wagner" 110-550 volts up to 100 horsepower. Types 40DA, 60DD, 60DC, 120DD, 120DE.

Oil-immersed switches and air-cooled transformers mounted in metal cases. In the off position the switches disconnect the motor and transformer windings from the line.

Approved April 3, 1914.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

A combination outlet bushing and coupling, catalog No. 911, for use with armored cable at switch boxes. A copper-plated steel sleeve with a prong formed at one end is secured under a screw in the center of the box. The other end is formed into a split clamp collar with a binding screw for securing the cable. (See cut.)

Approved March 25, 1914.

CUTOUT BASES, Cartridge Fuse.—E. H. Freeman Electric Company, Trenton, N. J.

"Freeman," porcelain base.

0-30 amperes, 250 volts; catalog Nos. 403, 410, 412, 420, 422, 425, 427, 429.

31-60 amperes, 250 volts; catalog Nos. 404, 411, 413, 421, 423, 426, 428, 430.

61-100 amperes, 250 volts; catalog Nos. 405, 414, 415.

Approved March 27, 1914.

FIXTURE WIRE.—Atlantic Insulated Wire & Cable Company, 120 Liberty Street, New York, N. Y.

Marking: Green and black threads crossing in braid, or, green and black threads parallel to wire under braid.

Approved April 3, 1914.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Motor starters, direct current; bulletin Nos. 2110, 2120, 2125, 2130, 2140, 2150, 2170, 2171, 2180, 2190, 2210, 2220.

Alternating current; bulletin Nos. 9110, 9113, 9120, 9125, 9130.

Speed regulators; direct current; bulletin Nos. 3110, 3130, 3140, 3150, 3230, 3235, 3240, 3250, 3260, 3320, 3340, 2310, 2350, 8520.

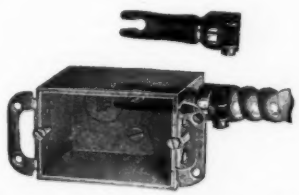
Alternating current; bulletin Nos. 9300, 9320, 9375.

Starting and regulating "Compound" type, direct current; bulletin Nos. 2230, 2240, 2245.

Controllers; bulletin Nos. 4100, 4110, 4130, 4140, 4200, 4210, 4220, 4230, 4240, 4250, 4300, 4310, 4320, 4330, 4340, 4350, 5900, 9335, 9340.

Field regulators; bulletin Nos. 1110, 1130, 1140, 1150, 1160.

Theater dimmers, "Simplicity"; bulletin Nos. 8500, 8502, 8505.



Outlet Bushing and Coupling—Hart & Hegeman Manufacturing Company.

Resistance plates, "Iron Clad"; bulletin No. 1250.

Treadle controllers; bulletin Nos. 8625, up to 0.25 horsepower, 125 or 250 volts.

Spot-light dimmer; bulletin No. 8515.

Battery charging; bulletin No. 8540, 8560, 8570; protective devices for same; bulletin No. 8550.

Approved March 27, 1914.

SIGNS, Electric.—Robert K. Witz, 1215 North Robey Street, Chicago, Ill.

Show-window sign, consisting of an inclosure in which are mounted receptacles for four incandescent lamps and provided with a door with slides in which lettered glass plates may be inserted. A junction box is provided in which connection may be made to supply circuit.

Approved March 30, 1914.

SWITCHES, Automatic.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Push-button stations, for use with automatic controllers, bulletin No. 8645.

Approved March 25, 1914.

SWITCHES, Combination Cutout.—Barkelew Electric & Manufacturing Company, Middletown, O.

"Star," equipped with clips for standard cartridge fuses mounted between cross bar and hinge clips. All capacities, 250 volts, direct-current and alternating current; 500 volts, alternating current and direct current.

Approved March 18, 1914.

SWITCHES, Combination Cutout.—E. H. Freeman Electric Company, Trenton, N. J.

Service cutouts with porcelain base, knife switch and cartridge fuses, 30 amperes, 250 volts; catalog No. 1801, 1803.

Approved March 26, 1914.

WIRES, Rubber-Covered.—Atlantic Insulated Wire & Cable Company, 120 Liberty Street, New York, N. Y.

Marking: Green and black threads crossing in braid, or, green and black threads parallel to wire under braid.

Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters' Laboratories, have labels attached to each coil.

Approved April 2, 1914.

WIRES, Rubber-Covered.—Canada Wire & Cable Company, Limited, 1160-70 Dundas Street, Toronto, Canada.

Marking: One red thread woven in the braid, or, white threads crossing in red braid.

Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached to each coil.

Approved March 31, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

NEW YORK, N. Y.—Columbia Mills Power has been incorporated with a capital of $500,000 to engage in the business of electric transmission. G. H. and W. R. Hees, T. D. McChesney are the incorporators.

HIGH BRIDGE, N. J.—The Hunterdon Electric Light & Power Company is considering the extension of its transmission lines to Hampton and Glen Gardner to furnish electrical service to these towns. Knox Taylor is president.

JOHNSTOWN, PA.—Work will begin at once upon an extension of the Southern Cambria's railroad system from Woodland Park, near Ebensburg to Nant-y-Glo, the first step by the traction system to tap the rich mining field in the Blacklick region of which Nant-y-Glo and Twin Rocks are the centers. Address P. J. Little, president, for desired information.

PHILADELPHIA, PA.—The Philadelphia Electric Company has decided upon plans for a new substation to be erected at Germantown and Moreland Avenues. N.

POTTSVILLE, PA.—The Union Knitting Mills, of which J. I. Reed is proprietor, will install in the near future, their own electric power plant.

SCRANTON, PA.—Close to $1,000,000 will be used by the Scranton Electric Company in making improvements in Scranton and the Valley during the year, the American Gas & Electric Company, which controls it, having acted favorably upon the recommendations of Vice-president and General Manager Duncan Campbell for the 1914 appropriation.

SOUTH ATLANTIC STATES.

RICHMOND, VA.—A charter has been granted the American Water Works & Electric Company with a capital of $25,000,000. The concern is empowered to own, operate and to build water and electric plants along with other broad powers. H. Hobart Porter, New York, is president; Henry H. Pierce, New York, is secretary; Charles L. Scott, Hempstead, L. I., is treasurer.

NEW ZION, S. C.—The New Zion Telephone Company has been incorporated with a capital stock of $1,500 by E. B. Gamble, W. C. Plowden, P. M. Gibbons and others.

TURBEVILLE, S. C.—The Turbeville Telephone Company has been incorporated with a capital stock of $15,000 by M. J. Morris, D. L. Green and others.

EATONTON, GA.—On June 8 an election will be held to decide the question of issuing $25,000 for purchasing and developing waterpower at Griffin Mill on Little River, and installing an electric lighting system. Address M. A. Shivers, chairman of Special Committee of Light and Water Boards.

WEST PALM BEACH, FLA.—The City Council has accepted the bond offered by holders of a franchise for building and operating an electric railway, it being provided that not less than $10,000 shall be expended for construction of the line within a year. Address C. N. Newcomb.

NORTH CENTRAL STATES.

CINCINNATI, O.—The County Commissioners of Hamilton County, O., are preparing to issue $500,000 of bonds for the purpose of erecting a new courthouse, which will be wired throughout for the use of electricity. Electric elevators will also be required for the courthouse. L.

CINCINNATI, O.—The United Light Company has been incorporated by Willard H. Odell, William R. Divers, Albert D. Alcorn, Grace Divers and Frank A. Cooper, for the purpose of dealing in electric and gas supplies. The capital stock is $5,000. L.

COLUMBUS, O.—Electricification of the pumping equipment at the central sewage pumping plant and the Main Street station is contemplated by Jerry O'Shaughnessy, superintendent of water works.

DEGRAFF, O.—Extensive repairs are needed at the electric light plant. Address J. S. Doane.

DELAWARE, O.—This city has disposed of bonds to the value of $41,400, at a premium of $983, the proceeds to be used among other purposes for the construction of improvements and additions to the electric light plant. The mayor can give information regarding the work contemplated.

MARION, O.—Additional cluster lights may be placed. Address the city clerk.

LA FAYETTE, IND.—Lafayette & Northwestern Railroad Company has been incorporated with a capital of $100,000, to operate interurbans. O. L. Brown, G. J. Thomson, O. A. Cummins, A. P. Rainier are the incorporators.

MARTINSVILLE, IND.—Electric lights for outlying sections of the city have been ordered by the City Council, which also has provided funds for the installation of cluster lights at the city hall. G.

ANDERSON, IND.—City Engineer Funk has completed specifications and estimates for the system of street lighting to be provided for the uptown district. His estimate is that 308 ornamental posts with five lamps to each cluster will be required and that the cost of installation will be $30,000.

COLUMBUS, IND.—An overhauling and an enlargement of the municipal lighting plant is provided for in an order recently given by the City Council. G.

HAVANA, ILL.—Negotiations will shortly be taken up between the Havana Commercial Association and the Illinois Central Electric Railway, looking toward the electrification of the Havana line of the Burlington, from Lewiston to West Havana.

SHELDON, ILL.—A municipal light plant will be established here. Address F. S. Willand, city clerk, for particulars.

CLARA CITY, MINN.—A special election will be called to decide the question of issuing $5,000 electric light bonds. Address the city clerk for general information.

PILLAGER, MINN.—The Clover Land Telephone Company has been organized here. The line will run to Pillager and Motley. Roy Jacquith and Charles Wright are interested.

CEDAR RAPIDS, IOWA.—The State Railroad Commission has granted a franchise to the Iowa Railway & Light Company, of Cedar Rapids, to build a transmission line from Cedar Rapids to Tama, as part of a proposed line to Marshalltown.

DENNISON, IOWA.—The voters have voted to buy or erect a municipal lighting plant. Address the city clerk.

DES MOINES, IOWA.—New street lamps carrying street signs may be installed by the city after May 1, when the ten-year contract with the Welsbach Lighting Company expires. Address the city clerk.

SHELLSBURG, IOWA.—At a special election held here the question of granting a franchise for an electric lighting and power plant carried and a franchise has been granted to F. J. Cross, who expects to have the plant in operation sometime this summer.

JOPLIN, MO.—The Century Engineering Company will build a trolley line between Columbus, Kansas, and Miami, Okla. Address George D. Thayes, secretary, for information.

ST. LOUIS, MO.—Electric Light & Power Company of Sullivan has been incorporated with a capital stock of $25,000 by Richard Zinkmann, E. W. Illien and W. E. Anderson.

SPENCER, S. D.—The Spencer Light & Power Company has been incorporated with a capital stock of $10,000 by William Hoese, H. C. Sleuth and others.

WINNER, S. D.—The Ideal Telephone Company has been organized here. W. W. Lenker is president and L. J. Auble secretary.

BLUE RAPIDS, KANS.—The Marshall County Power & Light Company will increase its capitalization to $50,000 and make numerous improvements. A 300-foot cement retaining wall will be constructed, and combined water wheels and generators of 220 horsepower installed. B. F. Eyer is general manager of the company. N.

VERMILLION, KANS.—A transmission line will be built from Vermillion to Frankfort at a cost of $7,000. Bonds were voted at a recent election for this purpose. M.

SOUTH CENTRAL STATES.

BURGIN, KY.—Construction and operation of an electric light and power plant is projected for Burgin. The project is being led by W. H. DeBaun, of Perryville, Ky. G.

FULTON, KY.—Improvements and extensions made or projected by the Fulton Electric Light & Power Company will be taken care of by a bond issue which will be put on the market in a short time. The plant was recently rebuilt by the National Light & Power Company, of St. Louis, and the same concern is similarly interested in an electric plant at Hickman. G.

GREENSVILLE, KY.—A hydroelectric plant on Green River, near here, will be one of the results of the successful financing of the project for the building of the Central City, Greensville & Drakesboro Electric Railway to connect those western Kentucky towns. The plant will supply not only the power for the operation of the railway but will be in position to supply the towns in its locality with electric current for all purposes. G.

HARRODSBURG, KY.—Improved electric lighting is proposed. Address J. G. Pullman, mayor, for general information.

LOUISVILLE, KY.—Under its charter, the Southern Utilities Company, recently incorporated here with a capital of $10,000, is authorized to build and operate electric light and power plants, hydroelectric plants and to construct and operate other public utilities. At the present time the company has negotiations up with several towns in Kentucky, though none of these has as yet assumed definite proportions. M. H. Thatcher, formerly Federal Governor of the Panama Canal Zone, is attorney for the company and one of the incorporators. Other incorporators are J. F. Taylor and W. G. Dearing. G.

FRIENDSHIP, TENN.—The plant of R. T. Coffman will have to be increased to meet the demand for lights.

KNOXVILLE, TENN.—A complete double-track line will be constructed at Fountain City, by the Knoxville Railway & Light Company.

LENOIR, TENN.—Plans for the development of power on the Yadkin River, in Tennessee, are being prepared in a tentative way by David R. Shearer, consulting engineer, of this place. G.

McMINNVILLE, TENN.—The Home Telephone Company has been incorporated with a capital stock of $5,000 by L. B. Gilbert, W. C. Lorance and others.

NOLENSVILLE, TENN.—The Farmers Exchange Telephone Company has been incorporated with a capital stock of $3,000 by J. A. Williams, D. R. Gooch and others.

LITTLE ROCK, ARK.—The Little Rock & Pine Bluff Interurban Company will build a line 25 miles in length, according to the promoters, C. C. Kavanaugh and E. W. Jackson.

CORPUS CHRISTI, TEX.—John J. Runk, of this city, is interested in an electric line to be constructed to Ward Island, a distance of eight miles, where an amusement park is to be established.

DALLAS, TEX.—The Dan Sonnenthiel Company will extend its car line east of the city. Address Dan Sonnenthiel, general manager.

EL PASO, TEX.—Another addition is going to be built to the El Paso Electric Railway Company's plant to cost $20,000.

HOUSTON, TEX.—The Houston Harbor Board, Jesse H. Jones, chairman, will soon adopt plans for developing terminals at the turning basin of the Houston ship channel. Engineer J. F. Coleman has submitted tentative plans including the erection of an electric power plant and other equipment, in addition to the warehouses, docks, etc. D.

WESTERN STATES.

PHILLIPSBURG, MONT. — The Roya Basin Mining Company has decided to erect an electric power plant on Flint Creek, a short distance below the town of Maxville. U.

HURLEY, N. M.—The Chino Copper Company will enlarge the capacity of its electric power plant here. D.

BOISE, IDAHO.—Acting on the permission given him by the Federal Court recently to spend $220,000 in the completion of the Oxbow power plant on the Snake River, Receiver Ferris, of the Idaho-Oregon Light & Power Company, has put a crew of men at work. The plant, when complete, will furnish 5,000 horsepower. When it is found feasible a dam will be constructed across the river, and 32,000 horsepower will be developed. O.

CUL DE SAC, IDAHO.—W. J. Morrow, of Couer d'Alene, has petitioned the City Council for an electric lighting and power franchise. He purposes constructing a dam across Lapwai Creek about this city, to bring water in a pipe line to drive the electric dynamos. The plans made public provide for a complete light and power system, and it is expected a franchise will be granted without opposition.

LEWISTON, IDAHO.—Purchase of the power transmission lines of the Lewiston-Clarkston Improvement Company, from Leon Station, NezPerce County, Idaho, to Moscow, Idaho; Pullman, Uniontown and Colton, Wash., has been made by the Washington Water Power Company, of Spokane. Surveys have been made to Troy, Kendrick and Julietta, and it is understood lines will be built into that territory during the coming summer.

LEHI, UTAH.—The City Council has granted a 50-year franchise to C. W. Earl, of Salt Lake City, to construct, maintain and operate in this city an electric distributing system for the purpose of supplying the city with electrical energy for lighting, heating and power purposes. U.

SALT LAKE CITY, UTAH.—Mr. R. S. Campbell has presented an application to the City Commission for a franchise to construct and lay conduits throughout the commercial district for a heating and power distribution plant and system. Mr. Campbell claims that he and his associates will incorporate a company to be known as The Citizen's Public Utility Company to install and operate the system. U.

GLOBE, ARIZ.—The cost of a municipal light plant as estimated by Consulting Engineer H. L. Sawyer would be $89,800. Of this amount he figures $15,600 for the distributing system and the remainder for power plants, equipment, etc.

NOGALES, ARIZ.—An election will be held here on May 25 to decide upon the granting of an electric light and power franchise to S. S. Proto and M. M. Mansfield.

PARKER, ARIZ.—Articles of incorporation have been filed for the Colorado River Electric Railway Company, with a capital stock of $250,000, by Thomas Taylor, David Connor, J. E. Beck, W. H. Thorpe, I. W. Wallace and William Drury. The company proposes to construct electric railroads, and to maintain telephone and telegraph business in and around Parker and through the Colorado River Indian reservation. D.

TUCSON, ARIZ.—Work on construction of a power line through the Rillito River section will be started in a short time by the Tucson Gas, Light & Power Company.

BUCKLEY, WASH.—Puget Sound Traction, Light & Power Company, of Seattle, will begin work in the immediate future of constructing a transmission power line from the power station at Dieringer to this city. A 24-hour service will be inaugurated. O.

WENATCHEE, WASH. — Representatives of the Chicago, Milwaukee & St. Paul Railroad recently purchased a large amount of land on both sides of the Columbia River, below Priest Rapids, having in view the construction of a dam across the River, about 15 miles below Beverly, where, it is reported, a monster power plant will be constructed for the purpose of securing current to electrify its lines in this section. From an authentic source comes the information that the power plant will be erected as soon as the necessary permission is granted. O.

CANYON CITY, ORE.—David A. McKeown of Prairie City has filed an application for a permit to appropriate additional water from Strawberry Creek, in order to develop additional power to the extent of 1,527 horsepower.

ROSEBURG, ORE.—The California & Oregon Power Company has applied for permission to use the public roads in Douglas County for the construction and maintenance of poles and wires for the transmission of electric current.

REDDING, CAL.—The sum of $1,500 has been subscribed to build a telephone line from Watson Gulch, Ono and Igo to Redding.

ESCONDIDO, CAL.—Steps have been taken by the directors of the Escondido Mutual Water Company for the issuance of bonds on the system for $200,000 for the installation of electric light and power plants, the raising of a reservoir and other important improvements.

SACRAMENTO, CAL.—Plans are being completed for a sub-electric station to be erected here. Address E. M. Wilder, Commissioner, for particulars.

SAN MATEO, CAL.—Articles of incorporation are being drawn by the attorney of the San Mateo County Development Association for the holding company which is to obtain the requisite rights of way for the proposed independent electric railroad, which will extend 30 miles down the peninsula from San Francisco to Palo Alto. The directors of the company will be Terrence Masterson, of San Mateo; D. G. Doubleday, of Millbrae, H. C. Tuchsen, of Redwood City; F. A. Cunningham, of South San Francisco; E. M. Moores, of Burlingame; and M. B. Johnson, of Montara, the Association's president.

FINANCIAL NOTES.

Articles showing the New York Edison Company has increased its capital stock from $50,549,400 to $66,349,400, have been filed at Albany, N. Y.

The Ohio Public Utilities Commission has approved the application of the Cincinnati & Suburban Bell Telephone Company, for permission to issue $637,150 stock, the proceeds of which are to be used as follows: completing new building, $400,000; switchboard, $50,000; extension of cable and conduit systems, $187,150.

Arrangements have been practically concluded for the purchase of the $1,500,000 first-mortgage fifteen-year six-per cent bonds of the United States Light & Heating Company by a New York-Pittsburgh banking house. Announcement of the sale will shortly be made. Holders of about $600,000 of the $610,000 short term notes, which mature July 1 next, have agreed to exchange their notes for the new bonds. This means, practically, an extension of these notes for at least three years, as that is the earliest maturity of any of the new bonds.

Dividends.

	Term	Rate	Payable
Am. Dist. Tel. of N. Y.	—	1 %	May 15
Detroit United Ry.	Q	1.5 %	June 1
Mid. West Util., pf.	Q	1.5 %	June 1
Mobile Elec., pf.	Q	1.75%	May 15
Pac. Gas & Elec., pf.	Q	1.5 %	May 15
Tampa Elec.	Q	2.5 %	May 15

Reports of Earnings.

AMERICAN GAS & ELECTRIC.

American Gas & Electric reports for the year ended December 31, 1913:

	1913	1912
Gross earnings	$3,811,292	$3,338,770
Net earnings	1,024,715	915,439
Available for int.	994,403	930,369
Surplus after chgs.	680,303	616,269
Preferred dividends	99,690	99,057
Bal. for com'n stock	*580,613	517,212

*Equivalent to 16.59 per cent on $3,500,000 common stock.

ELECTRIC BOND & SHARE.

Electric Bond & Share Company reports for the year ended December 31, 1913:

	1913	1912
Gross income	$1,554,403	$1,556,979
Net income	1,129,395	1,226,657
Preferred dividends	277,900	160,932
Balance for common	*851,495	1,065,725
Common dividends	363,000	225,333
Surplus	488,495	840,392

*Equivalent to 17.29 per cent on $5,000,000 common stock.

CAROLINA POWER & LIGHT.

	1914	1913
March gross	$ 49,166	$ 40,105
Net after taxes	17,511	16,119
Other income	12,500	10,000
Surplus after charges	17,780	16,080
Twelve months gross	553,523	464,182
Net after taxes	197,227	153,340
Other income	52,500	40,000
Surplus after charges	107,930	88,926

MASSACHUSETTS ELECTRIC COMPANIES.

The report of the Massachusetts Electric companies for the quarter and nine months ended March 31, compares as follows:

Quarter:	1914	1913
Gross	$2,029,027	$2,027,976
Expenses	1,439,344	1,461,772
Net	589,683	566,204
Charge and taxes	484,234	450,045
Surplus	105,449	116,159
Nine months:		
Gross earnings	7,196,463	7,028,306
Exp. and Winter exp. fund	4,818,879	4,549,792
Net earnings	2,377,584	2,478,514
Int. and other chgs. (inc. txs.)	1,482,439	1,400,968
Net div. inc.	895,145	1,077,546

PROPOSALS.

ELECTRIC WIRING, ETC.—Bids will be received until May 14 for furnishing electric wiring, conduits, lighting fixtures, lamps and bells in the new Swinney School, to be built in Kansas City, Mo. J. B. Jackson, Jr., is secretary of the Board of Directors of the School District of Kansas City.

SWITCHBOARDS.—Sealed proposals will be received at the office of the General Purchasing Officer, Panama Canal, Washington, D. C., under Canal Circular 851, until May 23 for furnishing switchboards. Blanks and general information can be obtained from any of the assistant purchasing officers located in the large cities of the United States.

ELECTRIC CABLE.—Sealed proposals will be received at the office of the General Purchasing Officer, Panama Canal, Washington, D. C., under Canal Circular 848, until May 16 for furnishing electric cable, etc. Blanks and general information can be obtained from any of the assistant purchasing officers located in the large cities of the United States.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for interior lighting fixtures until June 1 of a two-story building for the post office at Brigham City, Utah; until June 4 of a one-story building for the post office at Newport, Ark., and of a two-story building for the post office at Arkansas City, Kans.; until June 9 of a two-story building for the post office at Chico, Cal., until June 10 of a one-story building for the post office at Lake City, Minn.; until June 11 of a two-story building for the post office at Bennettsville, S. C., all in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites named or the office of the Supervising Architect.

ELECTRICAL APPARATUS.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 26 for furnishing two electrically heated baths, as per Schedule 6722, for delivery at the Navy Yard, Newport, R. I.; 810 feet four-way vitreous conduit, as per Schedule 6731, for delivery at Navy Yard, Washington, D. C.; five electrically operated potato peelers, as per Schedule 6746, for delivery at Navy Yard, Norfolk, Va.; six ammeters, hot wire, unshunted, direct-reading, 0-40 amperes, and 2,600 feet interior communication cable, soft steel, galvanized, leaded or armored, four-conductor, both for delivery at the Navy Yard, Brooklyn, N. Y., as per Schedule 6740; also 4,000 feet armoring and leading single conductor, plain 150,000 centimeter cable, as per Schedule 6737, for delivery at the Navy Yard, Brooklyn, N. Y.; also 800 feet electric cable, 500,000 centimeters, as per Schedule 6731, for delivery at the Navy Yard, Washington, D. C.

NEW INCORPORATIONS.

OAK LEVEL, KY.—The Oak Level Telephone Company has been incorporated with a capital stock of $1,000 by R. C. Cox, Dr. Joe Woodall and others.

NEW YORK, N. Y.—Singer Electrical Company has been incorporated, capitalized at $5,000, to deal in electrical fixtures, etc. The incorporators are John H. Singleton, Andrew F. Bittner and Patrick J. O'Reilly, all of New York City.

AUBURN. N. Y.—The Stephenson Supply Company, Incorporated, has been incorporated with a capital stock of $7,200. The incorporators are David M. Osborne, Charles D. Osborne and Robert J. Stephenson, all of Auburn.

NEW YORK, N. Y.—Elk Manufacturing Company, Incorporated, has been incorporated to deal in electric terminals. The capital stock is $2,000 and the incorporators are Jacob S. Elkin, Ernest Heynemann, and Marie I. Bloomfield, all of New York City.

PHILADELPHIA, PA.—Crescent Engineering Company has been incorporated with a capital stock of $100,000 to carry on a general mechanical and electrical engineering business. The incorporators are F. R. Hansell, Philadelphia; George H. B. Martin, S. C. Seymour, Camden, N. J.

CLEVELAND, O.—The Elwell-Parker Electric Company, recently organized here with a capital stock of $100,000, will manufacture and deal in electric apparatus of all kinds. The incorporators are S. Q. Kerruish, W. M. Kerruish, G. E. Hartshorn, George W. Spooner and X. I. M. Harrivel. L.

BUFFALO, N. Y.—The Interstate Hydrostat Company has been incorporated with a capital stock of $200,000. The directors are Charles B. Sherwood, of this city; Michael Owen, Anthony J. Eckel, William Eckel and Dr. S. A. Lenhard, of Detroit. The company will manufacture and deal in electrical machinery.

CANAL DOVER, O.—The Braun-Hoff Electric Company has been incorporated with a capital of $50,000, to manufacture and deal in electric motors, generators and electric appliances and devices. William A. Braun, Jesse D. Baker, S. L. Holmes, C. E. Kreiter and G. A. Keyser are the incorporators.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 4	April 27
American Tel. & Tel. (New York)	121¼	119
Commonwealth Edison (Chicago)	133½	133½
Edison Electric Illuminating (Boston)	247	245
Electric Storage Battery, common (Philadelphia)	49	49¾
Electric Storage Battery, preferred (Philadelphia)	49	49¾
General Electric (New York)	147¼	140
Kings County Electric (New York)	120	120
Manhattan Transit (New York)	1	1
Massachusetts Electric, common (Boston)	9½	9¼
Massachusetts Electric, preferred stamped (Boston)	57	58
National Carbon, common (Chicago)	105	106
National Carbon, preferred (Chicago)	119	119
New England Telephone (Boston)	136	135
Philadelphia Electric (Philadelphia)	25¼	25½
Postal Telegraph and Cables, common (New York)	76½	75
Postal Telegraph and Cables, preferred (New York)	76½	67
Western Union (New York)	61½	60
Westinghouse, common (New York)	74	71
Westinghouse, preferred (New York)	119	117

PERSONAL MENTION.

MR. W. A. MOSER, of the local office of the Westinghouse Electric & Manufacturing Company, Salt Lake City, has been called to the factory at Pittsburgh, Pa., to spend a couple of months on some special work.

MR. GRIGSBY, managing director of The Benjamin Electric, Limited, London, E. C., England, sailed April 24 to make an eight-weeks' trip in the United States in the interests of his company. Mr. Grigsby is an associate member of the Institution of Electrical Engineers.

MESSRS. CHARLES W. GREEN and NORMAN OSANN have been advanced to the grade of assistant professors in electrical engineering, and MR. DEWITT M. TAYLOR to the grade of assistant professor in mechanical engineering by the Massachusetts Institute of Technology.

MR. JAMES P. DUSENBERRY, who has been treasurer of the Public Service Corporation, Newark, N. J., since its organization, has resigned. He will be succeeded by MR. PERCY S. YOUNG, comptroller of the corporation. Mr. Dusenberry has been connected with the gas and electric lighting interests of Newark for 44 years.

MR. E. A. WHARTON was elected president of the Marshall County Power & Light Company at the stockholders' meeting at Blue Rapids, Kans., on April 30. Others officers elected were MESSRS. W. E. HAM, vice-president; WILLIAM HUNTER, secretary-treasurer; B. F. EYER, general manager, and J. G. STRONG, local manager.

MR. JAMES R. KEARNEY has resigned from the Western Electric Company to accept a position as special representative with W. N. Matthews & Brother, St. Louis, Mo. Mr. Kearney has been in the electrical business for many years and has been connected with the Western Electric Company for nearly three years. He leaves that organization with many regrets.

MR. H. D. CURRAN, of the Curran Electric Sign Company, Spokane, Wash., was a Salt Lake City visitor last week. Mr. Curran has recently made a complete tour of the East, inspecting all of the sign manufacturers and signs of importance, looking for ideas to put into his work into Spokane. He was accompanied by Messrs. Eades and Russell, of the Washington Water Power Company, who are returning to Spokane from a trip East.

MR. CORLISS KEMERY, assistant manager of the Shenango Valley Electric Light Company, Sharon, Pa., has been appointed to succeed MR. J. C. CHESTNUT as superintendent when the latter goes to New Castle to become the head of the New Castle Electric Company, a subsidiary of the Mahoning & Shenango Valley Electric Company. Mr. Kemery has been with the Sharon office for the past six years. He is well and favorably known and his many friends are pleased to learn that he has been advanced.

MR. BEN S. READ, general manager of the Missouri & Kansas Telephone Company, with offices in Kansas City, Mo., was on May 1 appointed second vice-president of the Southwestern Bell Telephone Company, with headquarters at St. Louis, Mo. Mr. Read succeeds MR. E. D. NIMS, who was made first vice-president, in place of MR. E. S. BLOOM, who has been appointed one of the receivers for the Central Union Telephone Company. Mr. Read, who is 38 years old, has been with the Bell system for about 24 years; during which time he has been located at Louisville, Nashville, New Orleans, and elsewhere. He went to Kansas City as general manager in November, 1912. MR. P. H. HOPKINS, formerly general commercial superintendent, has been appointed acting general manager in Kansas City.

MR. ALLEN C. MORSE, for many years engaged in engineering work, has been appointed resident engineer and manager of the new office which has been opened at Cleveland, O., by McMeen & Miller. The latter company for more than 10 years has been conducting a general engineering practice with headquarters at Chicago. In its Cleveland office,

Allen C. Morse.

McMeen & Miller will continue to serve not only public service corporations, municipalities and commissions as may be required, but will devote particular attention to the rehabilitation of plants, the making of appraisals, the establishment of proper systems of records, and to any other work in which they may serve the interests of their clients.

OBITUARY.

MR. CHARLES B. HEWITT, a Philadelphia electrical contractor, died suddenly in his home in that city recently.

MR. THOMAS W. IRVIN, secretary of Cates & Shepard, electrical contractors, Philadelphia, Pa., died at his home in that city on Sunday, April 24, of heart disease. Mr. Irwin was a member of the Y. M. C. A. and Masonic Fraternity.

MR. WALTER WELLHOUSE, father of Fred Wellhouse, a well known electrical engineer of Boston, Mass., died at his home at Topeka, Kans., on May 2. The elder Mr. Wellhouse was secretary of the Kansas State Board of Horticulture.

MR. GEORGE H. POTTER, president of the Bradford Electric Light and Power Company, died at his residence in Bradford, on April 27. Mr. Potter was born at Rockford, Ill., July 12, 1847. At the age of 17 he enlisted in the United States navy and served about a year on the *Winnebago* of Admiral Farragut's fleet, and took part in the battle of Mobile Bay. After the war he went to the oil regions and located at Petroleum Centre. At the time of his death, besides holding the office of president of the Bradford Electric Light and Power Company, Mr. Potter was president of the Bradford Garage Company, vice-president of the Bradford Hospital Association, and a director of the Bradford National Bank. His widow and one daughter survive.

DATES AHEAD.

Electric Supply Jobbers' Association. May meeting, Chalfonte Hotel, Atlantic City, N. J., May 12-14. General secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

The Gas, Electric and Street Railway Association of Oklahoma. Third annual convention, Oklahoma City, Okla., May 13-15. Secretary, H. V. Bozell, Norman, Okla.

American Institute of Electrical Engineers. Annual meeting, New York, N. Y., May 19. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York City.

Association of Railway Telegraph Superintendents. Annual meeting, New Orleans, La., May 19-22. Secretary, P. W. Drew, 112 West Adams Street, Chicago.

Southwestern Electrical and Gas Association. Annual meeting, Galveston, Tex., May 20-23. Secretary, H. S. Cooper, Dallas, Tex.

Cleveland Electrical Exposition, May 20-30. Manager, William G. Rose, Wigmore Coliseum, Cleveland, O.

Missouri Electric, Gas, Street Railway and Waterworks Association. Annual convention, on board steamer *Quincy* en route from St. Louis to Keokuk, Iowa, and return, May 21-23. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

National District Heating Association. Sixth annual convention, Rochester, N. Y., May 26-28. Secretary, D. L. Gaskill, Greenville Electric Light & Power Company, Greenville, O.

Indiana State Electrical Contractors' Association. Convention, Indianapolis, Ind., May 28-29.

American Institute of Electrical Engineers. 296th meeting, Pittsfield, Mass., May 29.

National Electric Light Association. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Oregon Electrical Contractors' Association. Annual meeting, Portland, Ore., June 8-9. Secretary, J. C. Green, Portland, Ore.

American Society of Mechanical Engineers. Spring meeting, St. Paul, Minn., June 16-19. Secretary, Calvin W. Rice, 22 West Thirty-ninth Street, New York, N. Y.

American Institute of Chemical Engineers. Sixth semi-annual meeting, Troy, N. Y., June 17-20. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

Michigan Section, National Electric Light Association. Annual convention cruise leaving Detroit June 17, for the Thousand Islands and intermediate points, returning June 20. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

American Institute of Electrical Engineers. Thirty-first annual convention, Cadillac Hotel, Detroit, Mich., June 22-26.

National Electrical Contractors' Association. Annual convention, Cadillac Hotel, Detroit, Mich., July 15-18.

With the Electrical Manufacturers

Rome Wire Company, Rome, N. Y., has recently issued an attractive calendar for May, 1914.

The Multi Refillable Fuse Company, Chicago, Ill., announces its removal to new and larger quarters at 723 West Fulton Street.

Bridgeport Brass Company, Bridgeport, Conn., has issued a circular giving some good reasons for the steadily increasing demand for Phono-Electric trolley wire.

K. McLennan & Company, Chicago, Ill., sole manufacturers of Gale's commutator compound, have moved their offices from the Manhattan Building to 412 South Fifth Avenue, where more commodious headquarters have been established.

Lotz & Scheible, patent attorneys, announce that the growth of their practice has obliged them to move their offices into larger quarters; consequently the address has been changed to Suite 1063 McCormick Building, 332 South Michigan Boulevard, Chicago.

King Foundry Company, St. Joseph, Mo., has published a very handsome catalog entitled the "King White Way". This describes and illustrates the extensive line of King ornamental lamp standards and also details of a merchandising plan which has been widely accepted throughout the country and proven very popular and profitable.

Cresson Eectric Machine Company is constructing a machine shop and two auxiliary buildings at Cresson, near Johnstown, Pa. A specialty of the company will be the repair of electric mining machinery. The promoters are Messrs. Kirsch of Cherrytree, Indiana County, Pa., who have been conducting a similar plant at that place.

The Ohio Distributing Company, Chicago, Ill., announces the removal of its office and warehouse from the Hearst Building to 220 Lomax Place. The company is now representing the Western Conduit Company, Steel City Electric Company, National Electric Porcelain Company and the Bourn Rubber Company in the midde western territory.

Hazard Manufacturing Company, Wilkes-Barre, Pa., has recently issued a booklet containing the specifications for Hazard 30-per-cent para rubber and Hazard high grade wires and cables. In addition to giving the specifications for these wires and cables, this bulletin also contains several tables giving the results of various insulation tests.

Harrison Safety Boiler Works, Seventeenth Street and Allegheny Avenue, Philadelphia, Pa., is sending out a well illustrated circular calling attention to some of its steam-plant auxiliaries for the promotion of safety and economy. Among these are the Cochrane steam separator, oil separator, multiport safety valve, open feedwater heater, metering heater, water-softening equipment, etc.

The United States Light & Heating Company, Niagara Falls, N. Y., announces that its offices at 30 Church Street, New York City, will be moved on May 20 and will be located thereafter at the company's plant at Niagara Falls, N. Y. This transfer will result in bringing together the administrative sales, engineering and production departments, and will insure the most effective conduct of all in the interests alike of patrons and stockholders.

The Jefferson Glass Company, Follansbee, W. Va., will open a handsome display room in Chicago about May 15, occupying a five-room suite in the new building known as the Michigan Boulevard Building at Michigan Boulevard and Washington Street. An elaborate display of illuminating glassware will be exhibited. R. A. L'Ecuyer, who has been Chicago manager of the company for some time, will be succeeded by Albert W. Boulton, who will be in charge of the new offices and display room.

Westinghouse, Church, Kerr & Company, New York City, has been engaged by the Taylor Wharton Iron & Steel Company for the design and construction of a plant for the William Wharton, Jr., Company, to be erected at Easton, Pa. The plant will cover 25 acres and will include machine and grinding shop, blacksmith shop, foundry, pattern shop, storage buildings, office buildings and power plant. Construction work is to begin at once. The plant will be completed and in operation within one year.

National Lamp Works of General Electric Company, Cleveland, O., announces that its physical laboratory which formerly was known as the Physical Laboratory of the National Electric Lamp Association, will hereafter be known as the Nela Research Laboratory of the National Lamp Works of General Electric Company. Dr. Edward P. Hyde is director, as heretofore. The Laboratory's *Abstract-Bulletin* and other publications will continue to be issued from time to time by the Nela Research Laboratory.

Central Electric Company, Chicago, Ill., has recently issued a very attractive bulletin entitled "Ideal Lighting" which illustrates and describes Alexalite indirect and semi-indirect fixtures for offices, banks, salesrooms, hotels, hospitals, residences, public buildings, etc. Numerous excellent reproductions of various types of Alexalite fixtures are shown, each being accompanied by a full description together with the list price. The reflectors are all coated with a porcelain enamel and are so suspended as to be easily cleaned. The last 12 pages of the bulletin are devoted to news and lists of installations in various types of buildings.

The Robbins & Myers Company, Springfield, Ohio, announces with a good deal of pride that its basket ball team has carried off the championship in the Springfield Industrial League. Beside the Robbins & Myers Company the companies represented were the International Harvester Company, American Seeding Machine Company, the Kelly Motor Truck Company, Bauer Brothers Company and the Crowell Publishing Company. The Robbins & Myers team won every one of the 12 games in which they participated. The team was composed as follows: W. E. Bauer, C. A. Slack, H. I. Smeltzer, C. A. Stirling, W. A. Lubbers, O. C. Burmeister, J. P. Lafferty and O. B. Littick.

The Koerting & Mathiesen Company, New York, N. Y., the removal of whose plant and offices to 49-53 East Twenty-first Street was announced last week, states that this move has been made necessary due to the increase of business and also because of the fact that the company is now handling additional lines and is placing upon the market various forms of long-hour lamps for both interior and exterior use. The company will treble its facilities both in offices and stores. It is also announced that a line of motors and dynamos to meet the requirements of the American market will shortly be available. The offices will be handsomely fitted up and a showroom provided where models of all the apparatus and materials handled will be displayed.

Western Electric Company, New York, announces an alliance which has been formed between the Conlon Washing Machine Company, of Chicago, and the Western Electric Company. The entire line of Conlon electric washing machines will be marketed exclusively by the Western Electric Company under the trade name of the "Western Electric-Conlon." The selling arrangement involves no changes in manufacturing, and ample stocks will be carried at the 28 Western Electric distributing houses located at shipping centers throughout the United States. The Western Electric Company is planning a sales campaign, a feature of which will be a complete merchandising plan which will enable central stations and electrical dealers to aggressively push the sale of this machine.

The Electric Storage Battery Company, Philadelphia, Pa., has recently issued a booklet on the Exide charging system for garages. This system is an application of the constant-potential system for boosting. Under this system, for daily or regular charge, the voltage of the charging source is fixed and the batteries hence receive their charge without further attention. As a fully discharged battery will take very high current at first, the charging time will be comparatively short but the voltage is such as to cause no injurious gassing. Four curve sheets

are given showing the charging characteristics of various types of Exide batteries at the constant potential recommended and under various discharge states. A fifth curve shows the available capacities of the batteries after being charged under this system.

Beardslee Chandelier Manufacturing Company, Chicago, Ill., has recently issued catalog No. S-3 which is devoted to a description of various types of electric-light fixtures, fittings, etc. This catalog contains almost 800 plates, each illustrating a number of varieties of fixtures. Plain and ornate, direct, indirect and semi-indirect, electric and combination fixtures are described. Numerous ornate art-glass fixtures are also illustrated together with a color plate showing the colors in which art glass is furnished. The catalog covers a full line of ceiling and bracket fixtures suitable for the illumination of all types of buildings. The list prices of the fixtures are given in three columns. The first column gives the cost of unwired fixtures; the second, of wired fixtures; and the third complete with all glassware, sockets, etc., excepting lamps. Directions for ordering and a trade-discount sheet are included. The company is prepared to ship all chandeliers listed in the catalog within 24 hours after receipt of the order.

Edison Lamp Works of General Electric Company, Harrison, N. J., has recently issued bulletin No. 43,600, devoted to 750 and 1,000-watt nitrogen-filled Mazda lamps having efficiencies of 0.65 and 0.60 watt per candlepower. This is a preliminary bulletin on the subject and points out the high efficiency, high candlepower, superior color of light, simplicity and adaptability of these lamps. It is necessary that fixtures for these lamps be ventilated and when used outdoors they should protect the lamp from the weather. Bulletins Nos. 43,400, 43,401, and 43,402 have also been issued, being devoted to the lighting of wood-working plants, clothing factories and machine and metal-working plants. All of these bulletins are well illustrated by views of installations. Each bulletin considers the three methods of lighting namely, general illumination, localized general illumination, and combined localized and general illumination and the proper applications for each in the industries covered by these bulletins. Edison Mazda lamps for standard lighting service are listed in each bulletin and recommendations are made for the intensity of illumination which will be found most satisfactory for a number of operations. The May number of the *Edison Business Builder* which is now published as a monthly magazine, has also appeared. In addition to editorials of value to lighting companies and agents, it has several articles on lighting practice, magazine advertising, and co-operative publicity.

Record of Electrical Patents.

Issued by the United States Patent Office, April 28, 1914.

1,094,440. **Timing Device.** H. S. Hatfield, Brunswick, Germany. A liquid timing device for electric circuits.

1,094,441. **Block Signal System.** L. A. Hawkins, assignor to Union Switch & Signal Co., Swissvale, Pa. Signals automatically controlled by presence or absence of train in block.

1,094,467. **Method of Preparing Asbestos Fiber for Insulating Purposes.** H. L. Owen, assignor to General Electric Co. Consists in carding, taping and winding the fiber for applying to wire.

1,094,472. **Apparatus and Method for Counteracting the Inductance Disturbances in Telegraph Lines.** C. Priest, assignor to Commercial Cable Co., New York, N. Y. Includes a compensating cable.

1,094,479. **Switch Plug.** H. R. Sargent, assignor to General Electric Co. A rotary snap-switch plug. (See cut.)

1,094,487. **Ship's Course-Recording Device.** F. Spalazzi, Rome, Italy. Has electric means for transmitting and reporting compass movement.

1,094,494. **Electric Railway.** L. H. Thullen, assignor to Union Switch & Signal Co. Covers bonding of tracks and circuits for signal system.

1,094,495. **Signaling System for Railways.** L. H. Thullen, assignor to Union Switch & Signal Co. A modification of the above.

1,094,505. **Purification of Asbestos.** W. R. Whitney, assignor to General Electric Co. Consists of subjecting asbestos containing magnetite to the action of a solution of oxalic acid.

1,094,506. **Electric Iron.** H. Wicks, Cleveland, O. Covers mechanical and electrical details.

1,094,514. **Calculating Apparatus.** C. A. Bishop, New York, N. Y. Employs electromagnets.

1,094,528. **Spark Plug.** A. J. Champion, assignor to Champion Ignition Co., Flint, Mich. For internal-combustion engines.

1,094,530. **Temperature-Indicating Device.** M. S. Clawson, New York, N. Y. Electrode and metal retort form thermocouple controlling the galvanometer.

1,094,534. **Electric Switch.** R. Howard Conrad, Oakland, Cal. Knife blades held by electromagnetic lock.

1,094,539. **Process of Producing 1-3-Butylene-Glycol.** K. Delbrück and K. Meisenburg, assignors to Farbenfabriken Vorm. Friedr. Bayer & Co., Elberfeld, Germany. Comprises electrolytic reduction of aldol in acids.

1,094,540 and 1,094,541. **Fan.** H. J. Dilg, assignor to Eck Dynamo & Motor Co., Belleville, N. J. A combination motor-driven oscillating and ceiling fan.

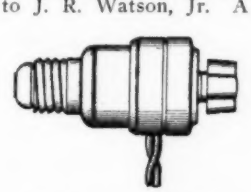
1,094,562. **Electric Switch.** O. H. H. Heins, Edgewater, N. J. A key-operated switch.

1,094,563. **Collector.** A. Helfenstein, Vienna, Austria-Hungary. A flexible third-rail contact member.

1,094,564. **Safety Device for Electric Cars.** J. E. Henderson, Birmingham, Ala. An electrically operated fender.

1,094,578. **Duplex Telegraphy.** I. Kitsee, assignor to American Telephone & Telegraph Co. Covers details of apparatus for duplexing.

1,094,584. **Signaling Device.** M. S. Morse, Oakland, Cal., assignor to two-fifths to J. R. Watson, Jr. A single



1,094,479.—Switch Plug.

contact operated by the vibration of rails due to the passage of cars.

1,094,591. **Automatic Controlling Means for Reversing Combustion Engines.** L. J. Le Pontois, New Rochelle, N. Y., assignor of one-half to B. Hurd. Ignition reversing means.

1,094,689. **Indicating System for Turrets.** F. W. Wood, assignor to Charles Cory & Son, Inc., New York, N. Y. Electric tell-tale system for showing the position of three turrets.

1,094,690. **Switch.** F. W. Wood, assignor to Charles Cory & Son. A cam-operated quick-break switch.

1,094,691. **Electrical Switch.** F. W. Wood, assignor to Charles Cory & Son. A multiple-contact switch.

1,094,693. **Oil Switch.** J. M. Andersen, assignor to A. & J. M. Anderson Mfg. Co., Boston, Mass. Insulating material placed between contact members.

1,094,694. **Oil Time Switch.** J. M. Andersen, assignor to A. & J. M. Anderson Mfg. Co. A modification of 1,094,694 having timing device.

1,094,699. **Safety Device for Overhead Electric Lines.** E. F. Bourdil, assignor to Société Anonyme Apicea, Paris, France. Includes means for preventing longitudinal movement of live wires.

1,094,700. **Mine Finder.** F. Bündgens, Kiel, Germany. Has lamp signal device.

1,094,704. **Sound and Image Producing Apparatus.** H. H. Clubb and R. A. Whitehead, assignors to Picture Disc Co., Los Angeles, Cal. Electrically illuminated display auxiliary to a phonograph.

1,094,711. **Electric Motor.** F. M. Fraser, Yonkers, N. Y. A rotatable-field electric motor with rope pulley.

1,094,714. **Reciprocating Heater.** W. S. Hadaway, Jr., New Rochelle, N. Y. Electric heaters and electrically controlled reciprocating means.

1,094,717. **Coupling for Electric Conductors.** J. L. Hinds and J. J. Dossert, assignors to Crouse-Hinds Co., Syracuse, N. Y. A lug and clamping arrangement.

1,094,718. **Electric Condenser and Method of Constructing the Same.** G. Honold, assignor to firm of Robert Bosch, Stuttgart, Germany. Process of manufacturing coiled condensers.

1,094,728. **Electrolytic Apparatus.** I. H. Levin, Newark, N. J., assignor to International Oxygen Co. Includes means for supplying electrolyte and controlling pressure.

1,094,732. **System of Distribution.** E. W. Lyle, assignor to General Electric Co. For reducing effects of variable line voltage by combining resistances having positive and negative temperature coefficients.

1,094,733. **Electric Regulator.** F. W. Lyle, assignor to General Electric Co.

An incandescent lamp containing hydrogen and a composite filament containing boron.

1,094,743. Street or Station Indicator. J. Lamburt Olson, St. Paul, Minn. Electrically operated and controlled.

1,094,745. Electric Incandescent Lamp. J. W. Phelps, assignor to General Electric Co. Has high and low candlepower filaments.

1,094,771. Electrically Heated Oven. H. P. Ball, assignor to General Electric Co. Has heat-insulated walls and a pivoted heating unit.

1,094,774. Process of Making Incandescent Electric Lamps. A. Berliner, assignor to General Electric Co. The glass parts are manipulated to form the bulb, etc., and the lamp is exhausted while still hot.

1,094,778. Vapor Electric Apparatus. A. Churchward, assignor to General Electric Co. Covers details of controlling means for a rectifier.

1,094,798. Safety Switch for Motor Vehicles. W. MacGlashan, assignor to Studebaker Corporation, South Bend, Ind. Auxiliary to the controller of an electric vehicle.

1,094,806. Switch. W. J. Newton, Lynbrook, N. Y., assignor to Metropolitan Electric Mfg. Co. A combination plug and wall switch.

1,094,829. Electrical Insulator. J. W. Aylsworth, assignor to Halogen Products Co., West Orange, N. J. Contains liquid chlorinated naphthalene having an anhydride dissolved therein.

1,094,839. Flashlight Device. R. M. Eaton, assignor to Niagara Searchlight Co., Niagara Falls, N. Y. Pocket battery lamp.

1,094,851. Electric-Resistance Device. W. S. Hadaway, Jr., New York, N. Y. A strip of resistance material inclosed in a metallic casing with slots for the terminals.

1,094,852. Insulator Pin. J. L. Hecht and J. C. Gapen, assignors of one-half to Electric Service Supplies Co., Philadelphia, Pa. Special bolt connection between the pin and crossarm. (See cut.)

1,094,855. Reed Hook. W. L. Keith, Milltown, Me. The handle has an electric light, shield and reflector.

1,094,870. Trolley Guard. J. H. Boyd, Carlisle, Pa. Guard arms on each side of the trolley wheel.

1,094,890. Trolley-Wheel Mount. W. Ficzek, Jersey City, N. J. Special harp construction.

1,094,894. Block Signal System. L. A. Hawkins, assignor to Union Switch & Signal Co., Swissvale, Pa. Relay-controlled alternating-current system.

1,094,903. Storage-Battery Electrode and Process of Manufacturing It. H. C. Hubbell, Newark, N. J. The active material is made by converting ferrous hydroxide into iron monoxide by heating without exposure to air, cooling and applying to the pockets of the plate.

1,094,907. Locking Device for Electrical Contacts. J. de R. Kielland, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. A lamp lock with spiral spring engaging the threads of the lamp base. (See cut.)

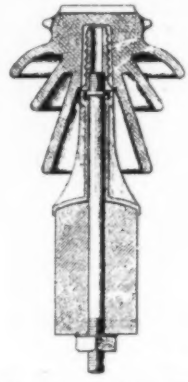
1,094,910. Corrugated Welding Strip. L. S. Lachman, assignor to Universal Electric Welding Co., New York, N. Y. A series of contact faces for electric spot welding are united by a metal strip.

1,094,912. Electric Furnace. T. Levoz, Heer, Belgium. For manufacturing steel electrolytically.

1,094,913. Block-Signal System. J. W. Murphy, Akron, O. Electrically controlled by selectors.

1,094,968. Telephone-Call Register. W. G. Bell, Newton, and W. H. Vinto, Boston, Mass.; said Vinto assignor to said Bell. For use at a pay station.

1,094,973. Vehicle Controlling Apparatus. T. Bodde, Brant Rock, Mass., assignor of one-half to A. G. Shaver.



1,094,852.—Insulator Pin.

Includes a dynamo whose poles can be magnetically shunted.

1,094,977. Supporting Bracket. R. B. Cable, Jr., Ridgwood, N. J. Adjustable support for lamp socket.

1,094,990. Branch Box. M. Havens, Jr., Albany, N. Y. The closure for the open side of the box has two plates holding insulating bushings for the wires.

1,094,991. Thermostat. R. E. Hinson, Hillsboro, Tex., assignor to one-half to S. Quayle. Governs an electric circuit.

1,095,007. Blind-Shaft Bearing for the Driving Means of Electric Locomotives. G. Lundholm, Vesterås, Sweden. The blind shaft is connected by double cranks to the motor shaft above it.

1,095,084. Signal Apparatus. V. J.

1,094,907.—Lamp Lock.

Crettol, Chicago, Ill. Electric alarm for a mail box.

1,095,112. Annunciator System. T. A. Haugaard, Cheyenne, Wyo. The hands of a chronometer actuate a circular series of switches arranged around the dial.

1,095,114. Device for Controlling Elevators. W. E. Brown, New York, N. Y. Includes a solenoid controlled by the elevator hand rope.

1,095,118. Device for the Production of Induced Currents in Magneto Machines and Dynamos. A. Keller-Dorian, Lyon, France. Covers details of an ignition magneto.

1,095,121. Cooling Device for Röntgen Tubes. J. A. Mannheim, Hamburg, Germany. A cooling rod is adapted to be set within the anticathode tube.

1,095,128. Method of Recording Musical Tones. C. F. Stoddard, Boston, Mass. Includes electrical control.

1,095,135. Fuse Holder. H. W. Young, Chicago, Ill. Covers details of construction of the cartridge casing.

1,095,138. Push Switch. C. A. Bates, assignor to Bryant Electric Co., Bridgeport, Conn. A pendent push-button switch.

1,095,170. Alternating-Current-Rectifying Apparatus. C. P. Steinmetz, assignor to General Electric Co. A mercury-vapor rectifier is arranged to supply the direct-current circuit continuously with a predetermined amount of current; means are provided for returning energy from this circuit to the supply system.

1,095,175. Mercury-Vapor Lamp. R. Küch, assignor to General Electric Co. Shaped like a dumbbell.

1,095,178. Mechanism for Controlling the Speed of Turbines or Other Prime Movers Connected in Parallel. H. E. Warren, assignor to Lombard Governor Co., Ashland, Mass. The combined load of the generators is made to affect the pressure of the fluid supplied to the turbines.

Patents Expired.

The following United States electrical patents expired May 4, 1914.

581,706. Electric Switch. G. T. Eyanson, Philadelphia, Pa.

581,715. Electric Cable. M. Guilleaume, Mulheim-on-the-Rhine, Germany.

581,718. Electric Cigar-Lighter. H. M. Handshy, San Antonio, Tex.

581,769. Electric Railway. H. C. Reagan, Jr., Philadelphia, Pa.

581,802. Aero-Electric Whistle. C. R. Alsop, Middletown, Conn.

581,815. Telegraphy. C. F. Eaton, Jr., Santa Barbara, Cal.

581,840. Tool for Appliance for Use in Truing Up Commutators of Dynamos, Electric Machines, Etc. W. T. Adams, London, England.

581,873. Electric Transformer. E. Thomson, Lynn, Mass.

581,932. Carrier for Signal Wires. J. Chalmers, Jr., Pittsburgh, Pa.

581,997. Electric Arc Lamp. M. S. Okun, New York, N. Y.

582,036. Electrical Fuse Cutout. W. C. Bryant, Bridgeport, Conn.

582,102. Controller for Electric Cars. A. Schmid and H. P. Davis, Pittsburgh, Pa.

582,107. Selective Signaling Circuit, Apparatus and System. G. W. Whittemore and J. A. Barrett, Brooklyn, N. Y.

582,111. Switch for Electric Circuits. A. J. Wurts, Pittsburgh, Pa.

582,114. Controller for Electric Motors. H. P. Davis, Pittsburgh, Pa.

582,115. Method of and Means for Controlling Electric Motors. H. P. Davis.

582,120. Astatic Galvanometer. A. Frank, Berlin, Germany.

582,131. Alternating-Current Regulation and Distribution. B. G. Lamme, Pittsburgh, Pa.

582,132. Alternating-Current Motor. B. G. Lamme.

582,149. Electric Switch. J. A. Spiker, Grand Island, Neb.

582,157. Telegraphic Apparatus. C. F. Easton, Jr., New York, N. Y.